# WEB BASED DISASTER INFORMATION SHARING PLATFORM, "GeoWeb" USING OPEN SOURCE SOFTWARE AND FREEWARE FOR RURAL AREAS

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**ABSTRACT:**

In Japan, Ministry of agriculture, forestry and fisheries is responsible for disaster reduction in rural areas and irrigation facilities, such as head works, irrigation canals, pump stations, landslides, farm ponds, etc. The sensor data collecting system for the detection of abnormal conditions of the irrigation facilities or landslide is now being replaced with new equipment. An event of disaster depends upon meteorological factors, various conditions of facilities, the flow of river, etc. Many different kinds of organizations, such as meteorological observatories, the river bureau, a land improvement district, etc., have observed data. If the residents in rural areas or the staffs of land improvement bureau want to know the risk of disaster, they must collect many kinds of data from many organizations. But such kind of data is related to the location. Therefore in case that each organization opens the observed data to the public using WMS, WFS, WCS or under the ISO TC211 standards, the data users can easily obtain such kind data associated with location information through the Internet. This kind of www server is called "GeoWeb". The author conducts an experiment on making it and trying to find problems.

## 1. INTRODUCTION

### 1.1 Introduction

The author and his colleagues have experiences to make a sort of data retrieval and map painting system on the client browser from agricultural database using Web based GIS tool, AutoDesk MapGuide. (1998 and 2000　See Figure1.) And the author often pointed out the possibility of "GeoWeb", a kind of Web based information sharing system. Recently, Open source and free software for making "GeoWeb" is quickly growing. Therefore the author tried to make a "GeoWeb" using open source software for information sharing in case of disaster.

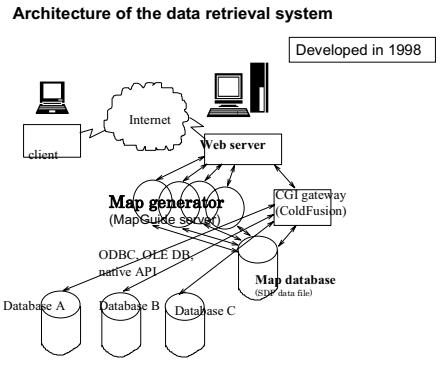


Figure 1．Architecture of the data retrieval system developed in 1998

### 1.2 What is "GeoWeb"?

When natural disaster, such as heavy thunderstorm, flood, landslide, earthquake, occurs, the people, who lives in the stricken area or must make decision for the quick response, are sure that they want to know the overall circumstances of the disaster as soon as possible. Many kinds of organizations, such as a meteorological observatory, the river bureau, a land improvement district, etc. have the observed data, such as radar thunderstorm, precipitation, water level of a stream-flow, etc. The information user should check the thunderstorm cloud location and river water level reported by the world wide web of a meteorological station and a river management authority for example. But the users should know the URL beforehand or use a search engine and specify the URL on their browser for every world wide web server site. (See Figure 2.)

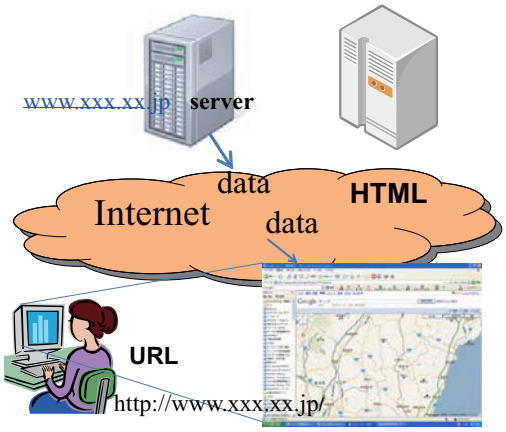


Figure 2.An ordinary word wide web

But the residents or the staffs of land improvement districts will desire to know the situation of disaster quickly and precisely when thunderstorm gives a localized downpour. Because such land improvement district controls drain water gates to the river of the drainage canal or open type irrigation channel. Therefore the way of information collection from the conventional world wide web is circuitous. As recently the number of such organization's staff members is decreasing, telephone communication between the people concerned is not the enough method. If the staff went to check the bar screen along the irrigation channel route for removing litters, there is no one in front of the electric flow control panel of the irrigation channel office. Then it is very important to improve the information gathering methods among those concerned.

The concept of "GeoWeb" is a possible solution to this question. (See Figure 3.) Ron Lake et al. (2004) explain the definition of "GeoWeb" as follows: "The Geo-Web is a distributed network of interconnected geographic information sources and processing services that are globally accessible, that is, they live on the Internet and are accessed through standard OGC and W3C interfaces, globally integrated data sources that make use of the GML data representation, and where appropriate, explicitly refer to one another." International Organization for Standardization (ISO) established several TC211 standards for Geographic information or Geomatics field. For example, ISO19136 is for the Geography Markup Language (GML), ISO19128:2005 is for the web map server interface. Also the Open Geospatial Consortium(OGC) fixed the Open GIS Web Map Service Interface Standard version 1.3.0.

There is one matter of concern about GeoWeb. When disaster occurred, people may rush into the same Web server. In order to avoid going down of the server system, access control process will be needed. Mr. Jan Herrmann pointed out this problem and he proposed some solutions. That is GeoXACML OGC candidate specification. (See Nayak,S., et al. Eds., 2008.)

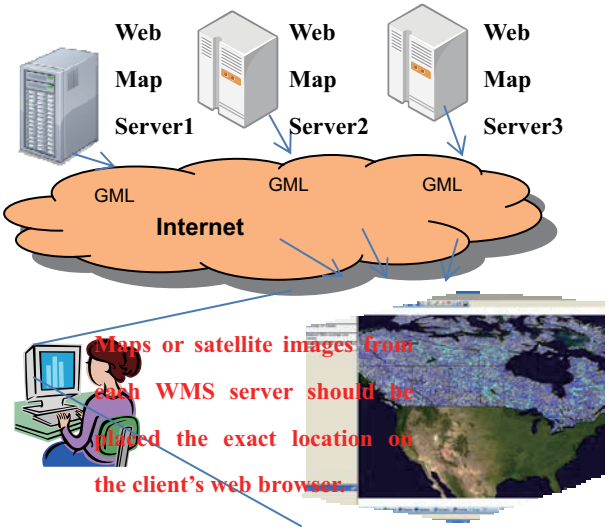


Figure 3. What is "GeoWeb"?

## 2. SYSTEM DESIGN FOR GEOWEB

The author made two type of GeoWeb for a prototype. The first is based on the Microsoft Windows operating system. The second is based on the Linux OS. Both systems were made by the combination of some open source and free software.

For Microsoft WindowsXP OS, the "OSGeo4W.exe" package is useful and almost all-in-one set, including Apache, PHP, MapServer, GDAL/OGR, python, QGIS, udig, tcltck, zlib, etc. The OpenLayers is for dynamic displaying of the add-on MapServer software using JavaScript. Addition to such software, the OSGeo's WinGRASS package is including the windows based "GRASS", the stand-alone GIS. The PostgreSQL plus PostGIS is for the GIS data storing and data searching tool.

For Linux OS, to make the GeoWeb will be more difficult than Windows based one. The system design for the Linux based GeoWeb server consists of CentOS, Apache, MapServer, GDAL, OpenLayers, PostgreSQL, PostGIS. And it for Desktop is GRASS, QuantumGIS, uDig. (See Figure 6.) Also the client side environment is similar to this. (See Figure.4)

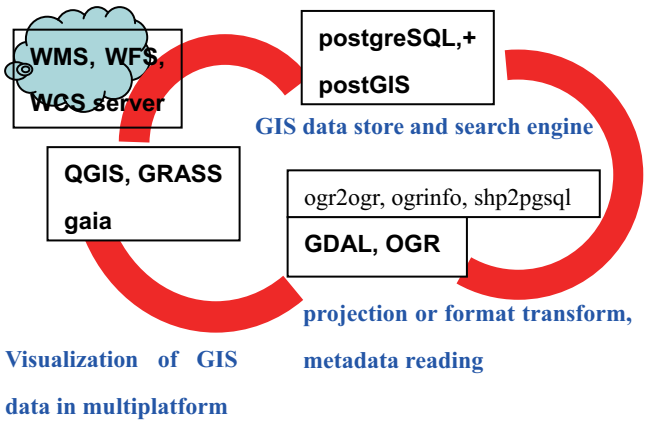


Figure 4. client environment under the open source approach (This figure is modified and added the Dr. Imaki, H.'s original one.)

## 3. GEOWEB IMPLEMENTATION

The author practically made a prototype GeoWeb server using the CentOS Linux based one. The sample map data and satellite data are the Orkney's digital Japanese maps and ALOS/AVNIR-II geotiff image. (Figure 5.. and 6.)

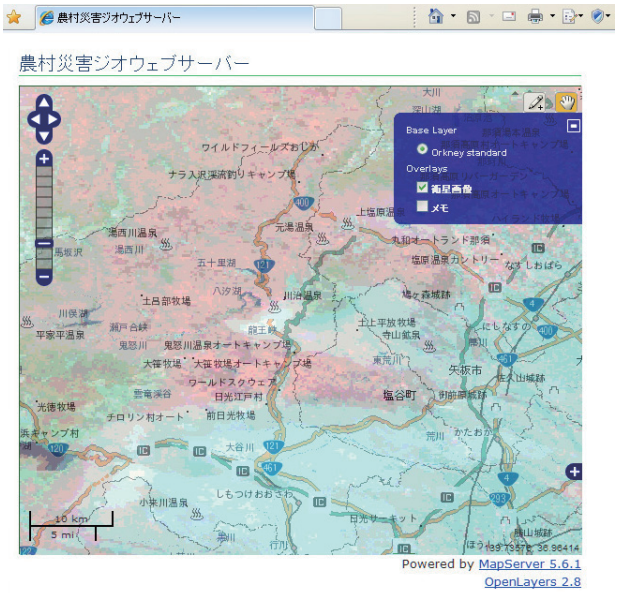


Figure 5. a sample browsing view of the implemented GeoWeb

## 4. APPLICATION TO THE PRACTICAL USE

The author plans to apply the trial implemented GeoWeb server into the practical use this year. The candidate region is Tochigi prefecture, the suburbs of Tokyo metropolitan area. Tochigi region is famous for having a lot of thunderstorms in summer. Thundercloud is quickly moving and very local place has heavy rain in a short time. Surface runoff will increase suddenly and some of the runoff pours into open channels for irrigation. There is spillway on the canals: but if the rainfall is beyond the expectation, the staffs of the land improvement district should open the gate of the waste-way out to the river. Sometimes, the trash-rack screen of the open channel for getting rid of suspended matters gets plugged during such thunderstorm. The staff must remove those litters from the screen at the height of storm. If the small number of staffs can operate the irrigation system, they may want to know about the situation of thunderstorm and the condition of irrigation canals quickly and easily. Tokyo Electric Power Company is releasing the information of rainfall and thunder observation data through the world wide web. (http://thunder.tepco.co.jp/) Japan Meteorological Agency puts the radar nowcast figure

into the public through the Internet. (http://www.jma.go.jp/jp/radnowc/) Ministry of Land, Infrastructure, Transport and Tourism throws the real time information of river state, such as rainfall, river water level, etc. open to the public using the world wide web. (http://www.river.go.jp/) But as this kind of information is on the deferent web server, they have to access each web site.

Now those organizations don't put the meteorological information into the public using the "GeoWeb". The author plans to measure the rainfall by using logger recording rain gauges and the collected rain data are put into the other implemented GeoWeb server database. The user can experience such kind of GeoWebs simulatively.

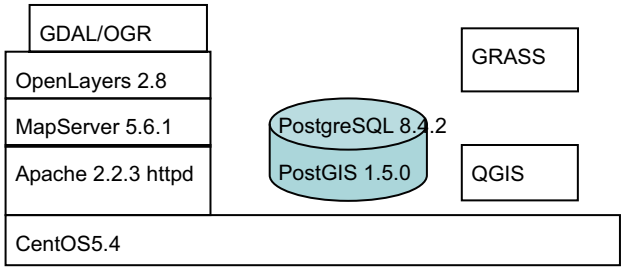


Figure 6. the composition of the ISO standard implemented GeoWeb using open-source software

## 5. CONCLUSIONS AND DISCUSSION

### 5.1 What is the difference from Google Earth?

The ISO standard implemented GeoWeb is apparently similar to the Google Earth picture. But Google technology is using another OGC criteria. They adopt KML language not GML; they use the WMTS (Web Map Tiling Service), not WMS (Web Map Service). The KML and WMTS may be easier than ISO's standard for web application programmers. But the base map is provided by only the Google company. Is it suitable for disaster information sharing platform or not? A question will remain doubtful.

### 5.2 How to extend the GeoWeb?

The procedure of implementation of GeoWeb is not popular in Japan. Those meteorological related organizations don't have the plan to make the GeoWeb server now. The satellite data distributors, such as JAXA or RESTEC in Japan may not have any plan to throw the observed satellite data open to the public using the GeoWeb. The dissemination of the GeoWeb technology is important in this stage.

As for the ISO standard for Web Map Service, web server is said sometimes under exposing to the heavy load from many users' requests. Hence in order to put the GeoWeb to practical use, it will need an access control test and loading test of the server. (Nayak, et al.:2008)

## REFERENCES

Brent Hall,G., Leahy,M., 2008 *Open Source Approaches in Spatial Data Handling.* Springer, Berlin, pp.65-199

Imaki, H. 2010. *Tokyo workshop textbook of 'Introduction to the Opensource GIS, For the spatial analysis begginers using PostGIS and QGIS'(In Japanese)*. NPO The Geoecological Conservation Network, Tokyo, pp.1-45 (http://hiroo.webfactional.com/opensourcegis/opensource_gis_lectures)

Jansen,M., Adams,T., 2010. *OpenLayers Webentwicklung mit dynamischen Karten* und Geodaten. Open Source Press, Muenchen, pp197-336

Kropla,B., 2005. *Beginning MapServer Open Source GIS Development,* APRESS and Springer, New York, pp1-368

Lake,R., Burggraf, D., et al., 2004. *Geography Mark-up Language(GML) Foundation for the Geo-Web*. John Willey & Sons Ltd., England, pp.7, 54-64

Li,J., Zlatanova,S. and Fabbri,A.(Eds.), 2007. *Geomatics Solutions for Disaster Management*, Springer, Berlin, pp.49-60, 225-254, 305-320

Mitchell,T.(Author), Ohtsuka,K.,etc.(Translators), 2006. *Web*

*Mapping Illustrated (translated into Japanese)*, O'Reilly Japan,Tokyo, pp.223-225

National Research Council,2007. *Successful response starts with a map Improving geospatial support for disaster management.* The National Academies Press,Washington,D.C., pp.1-147

Nayak,S. and Zlatanova,S., 2008. *Remote sensing and GIS Technologies for Monitoring and Prediction of Disasters*. Springer, Berlin, pp.121-178

Neteler,M., Mitasova,H.(Eds.), 2008. *Open Source GIS A GRASS GIS Applroach Third Edition.* Springer, New York, pp1-366

Obe, R., 2010. *PostGIS.* Manning Publications, chapter11 pp.1-35

Peter van Oosterom and Sisi Zlatanova, 2008. *Creating Spatial Information Infrastructures Towards the Spatial Semantic Web.* CRC Press, Boca Raton, pp.1-176

Pliz,J.(Ed.), 2009. *Interfacing Geostatistics and GIS*. Sringer, Berlin, pp.29-56

Scharl,A. and Tochtermann,K.(Eds.), 2007. *The Geospatial Web*, Springer, London, pp.174, 185, 254

Yamada,Y.a, 2008. Morphological Analysis of Flood Inundated Regions In Paddy Areas Using ALOS/PALSAR Data and its Distribution on the Google Earth—Design of the Future Disaster Management System(FDMS)--. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*. Vol.XXXVII. PartB4.Beijing, pp.1117-1122

Yamada,Y.b, 2007. Enhancement of the rural and irrigation system infrastructure to disasters with a help of IT. *Proceedings CD-ROM of 32nd ISRSE*, Costa Rica, pp.1-3

Yamada, Y., Utashiro, K., Kover, M., 1998. Painting maps and Making column charts, line graphs of International Agricultural Statistics Database on the client browser using Web based GIS tool (in Japanese). *Proceedings of Annual meeting of GISA, Tokyo*, pp297-298

Yamada,Y., Kover,M., Utashiro,K., 2000. Data retrieval and mapping system with Global Maps for the international statistics on agriculture using Web based GIS tool. *Proceedings of Global Mapping Forum 2000, Hiroshima, Japan,* pp.1-9

Wernecke, J., 2009. *The KML Handbook Geographic Visualization for the Web*. Addison-Wesley,Kendallville, pp.1-329

Zlatanova,S., Li,J., 2008. *Geospatial Information Technology for Emergency Response*. Taylor & Francis, London, pp. 1-373

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