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ASEAN Mineral Resources Information System using FOSS and OGC-based standards

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Abstract: Highly accessible mineral resources information encourages investment and more sustainable utilization of mineral resources. The Geological Survey of Japan, AIST developed the web based ASEAN Mineral Resources Information System using Free and Open Source Software (FOSS) and the Open Geospatial Consortium (OGC) standards. The use of FOSS and OGC compliant standards aims to make the mineral resources information system cost efficient, interoperable and user friendly. The developed system is composed of 3 modules which are the Database, Web Services and the Web Portal. The Database module is mainly PostGIS, a PostGreSQL open source object-relational database management system software. It supports simple features defined by OGC and simple Sequential Query Language (SQL). The Database module is a distributed database system comprising the individual mineral resources database of each country in the ASEAN region. It also includes the database of the geological map of East Asia and some ASTER and ALOS satellite images of the Geological Survey of Japan. The Web Service module is composed of the Web Processing Service (WPS) and Web Map Service (WMS). WPS handles the database maintenance and queries, including the data upload and download. WMS provides remote access to the mineral resources databases. It generates map images to be displayed on the Web Portal module. The Web Portal Module provides the web based Graphic User Interface (GUI) of the developed information system. It could also display map images provided by the Web Services module. The portal is named the ASOMM WebGIS system. This project aims to make mineral resources information in the ASEAN region easily available for use by policy makers, investors and the general public.

Keywords: Mineral Resources Information System, database, ASEAN

INTRODUCTION

The mineral sector has always been considered to be an engine for greater economic growth and social progress in the ASEAN region. Minerals in the region account for a relatively large shares of world reserves (Short *et al*., 2005). Easily accessible information about mineral resources enhances trade and investment in the sector. It also encourages environmentally sound and socially responsible mineral development practices and optimum utilization of mineral resources. A public that is well informed about this important resource will also discourage corruption.

As the economic integration of the ASEAN region progresses, unimpaired movement of capital and knowhow across the region should be guaranteed. This requires the creation of an information infrastructure that facilitates unhindered and efficient sharing of information. This project focuses on the creation of an information infrastructure that promotes sharing of information about mineral resources across the region, an initiative of the ASEAN Senior Officials Meeting on Minerals (ASOMM). The project involves the use of internationally accepted standards and cost efficient software. Specifically, this project is aimed at creating the web based ASEAN mineral resources information system using Free and Open Source Software (FOSS) and Open Geospatial Consortium Standards (OGC). OGC standards are technical documents that detail interfaces or encodings that software developers use to build open interfaces and encodings into their products and services (OGC, 2012a). The use of OGC standards and FOSS makes this information system cost efficient and interoperable. The develop system was also designed to be very accessible and easy to use. The ultimate objective of this project is to create an information technology platform for easy sharing and access of mineral resources information among ASEAN countries. Successful implementation of this project will make mineral resources information easily available for use by policy makers, investors and the general public.

ASEAN MINERAL RESOURCES INFORMATION SYSTEM

The ASEAN Mineral Resources Information System is a complete web-based system for storing, sharing and viewing mineral resources information in the ASEAN region. The system was developed following the application development guidelines of GeoGrid, National Institute of Advanced Industrial Science and Technology (AIST) which are as follows:

1) user-friendly
2) cost efficient
3) interoperable.

The system is composed of 3 modules which are the Database, Web Services and the Web Portal as shown in Figure 1.

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Figure 1: The 3 major components of the ASEAN Mineral Resources Information System.

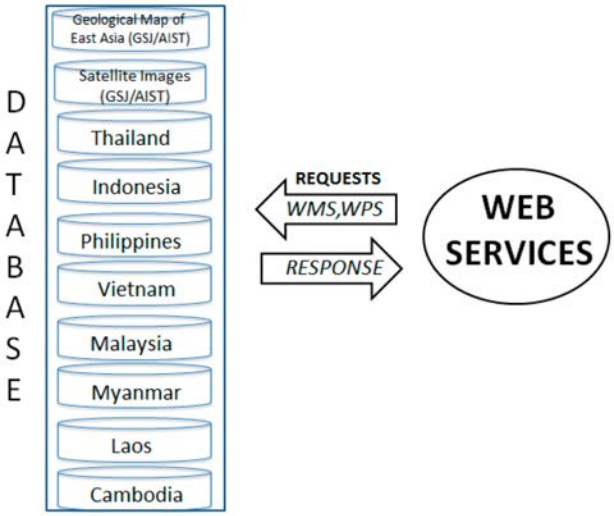

Figure 2: The database module of the ASEAN Mineral Resources Information System.

DATABASE MODULE

The database module is mainly a PostGIS database system. PostGIS is PostGreSQL open source object-relational database management system software that supports simple features defined by OGC, and simple feature Sequential Query Language (SQL). PostGIS supports simple and complex spatial queries, functionalities that are very important for handling mineral resources related information. The database maintenance and queries are initiated by Web Processing Service requests from the Web Services Module. The database module of the ASEAN Mineral Resources Information System is a distributed database system consisting of the individual mineral resource databases of the countries in the ASEAN region. The composite database also includes the geological map of East Asia and some ASTER and ALOS satellite images databases of the Geological Survey of Japan (Figure 2). Mineral resources information from individual databases is served as Web Map Service s, which receives requests from the Web Services module.

WEB SERVICES MODULE

Web Service Module follows the Open Geospatial Consortium standards (OGC). The module is composed mainly of the Web Processing Service and the Web Map Service (WMS). It receives requests from the Web Portal module, processes the requests and implements them on the Database Module. The WPS handles the database

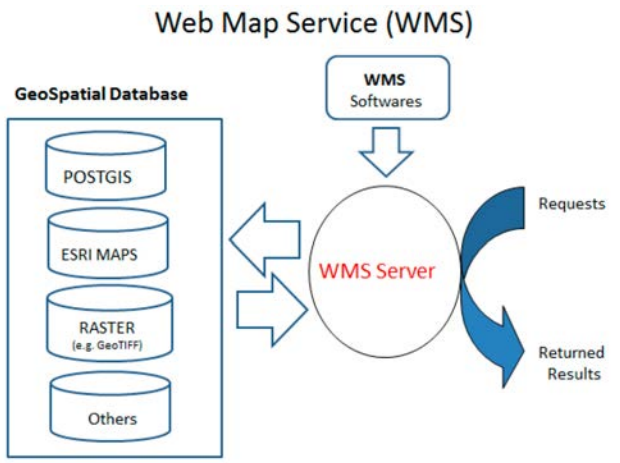

Figure 3: The Web Map Service (WMS).

maintenance and queries, including the data upload and download. The WPS component of this module is mostly implemented using PHP scripts. WMS is a standard protocol that provides a simple HTTP interface for requesting geo-registered map images from one or more distributed geospatial databases (OGC, 2012b). WMS provides map images online generated by mapserver software, in response to a GetMap request, using a GIS database (Figure 2). WMS provides remote access to the databases in the Database module, and generates map images for display on the Web Portal module.

WEB PORTAL MODULE

The Web Portal Module provides the web based Graphic User Interface (GUI) of the ASEAN Mineral Resources Information System. The portal is named ASOMM WebGIS system. It provides the interface and forms for the users to upload and download data, query the database and display the maps. Forms are provided for simple and complex spatial queries. Figure 4 shows the main page and main menu of the portal.

The portal uses the open source Openlayers Javascript libraries (OSGeo, 2012) for displaying maps on the site. The map images displayed are generated from the GetMap requests pointed to the WMS servers on the Web Services module. The site could display any kind of geographically referenced data including satellite images. It provides the standard GIS functions for manipulating maps. Figure 5 shows the map display page of the site showing metallic mineral occurrence in ASEAN countries overlaid over the geological map covering East Asia. Database queries could also be performed easily using the site. Figure 6 shows a single mineral query form of ASOMM WebGIS. Query results could be downloaded in ArcGIS shape file or KML formats. Figure 7 shows the downloaded query results in KML format displayed using Google Earth.

SUMMARY

The ASEAN Mineral Resources Information System is a web-based application that provides a cost efficient and

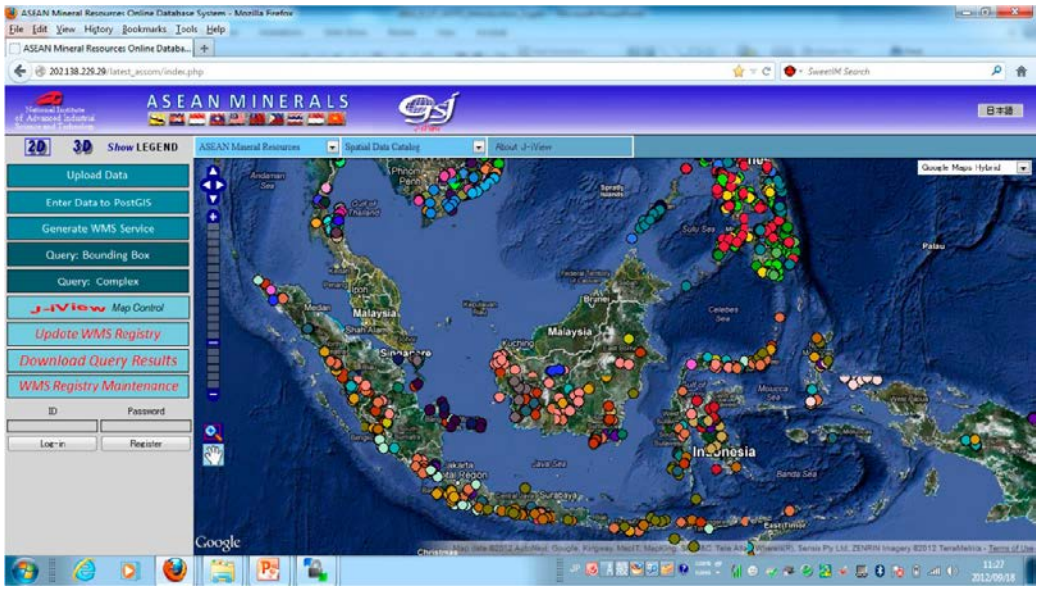

Figure 4: The main page of ASOMM WebGIS.

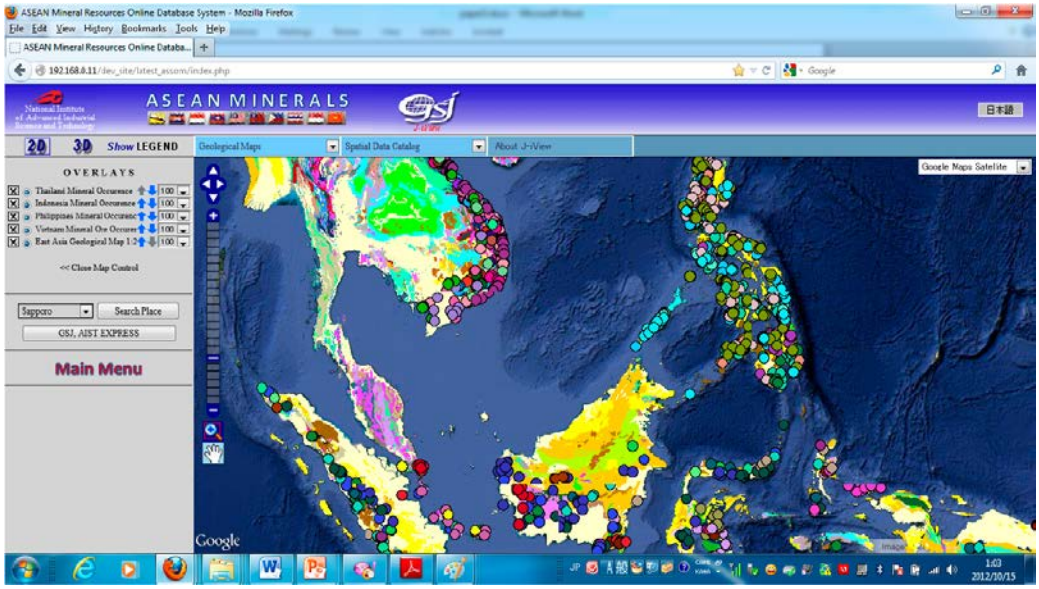

Figure 5: The map display page of the ASOMM WebGIS.

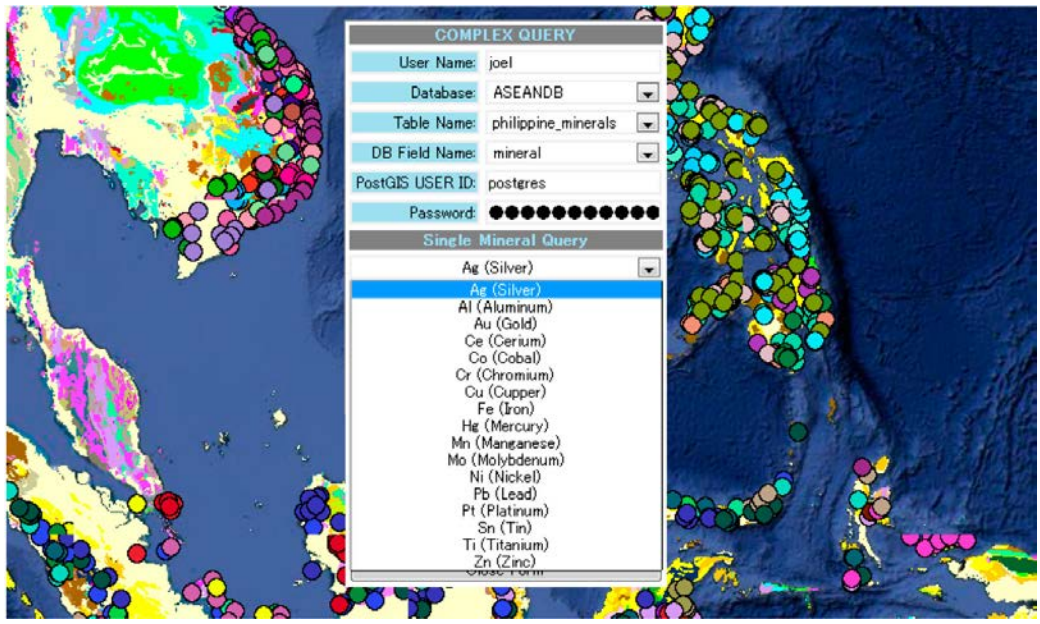

Figure 6: The single mineral query form of ASOMM WebGIS.

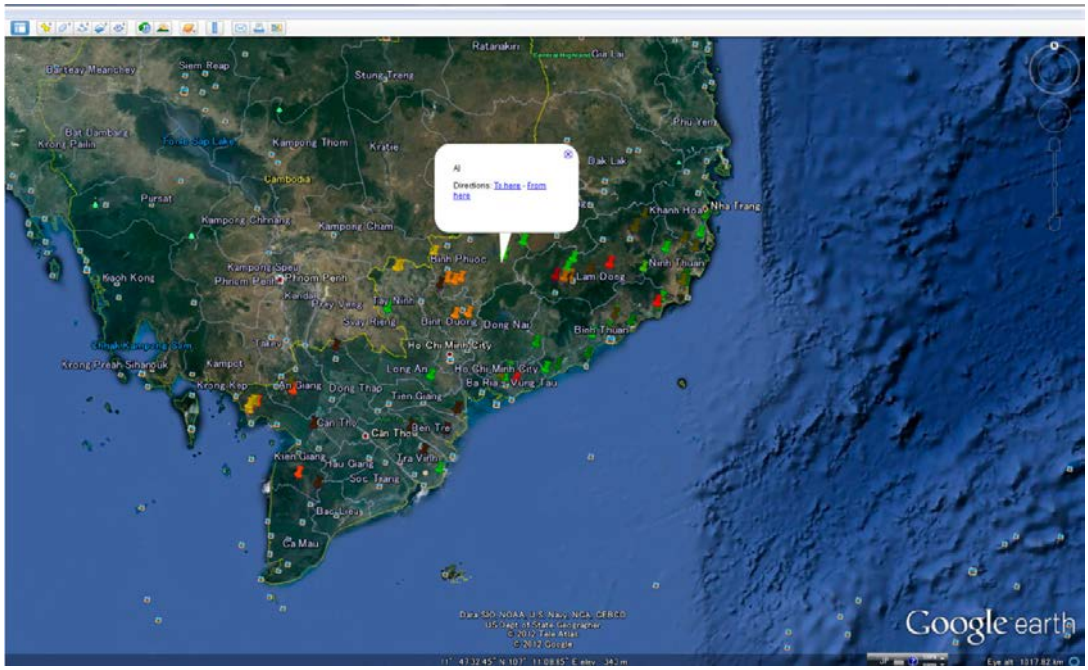

Figure 7: Downloaded query results in KML format displayed using Google Earth.

easy to use information technology platform for sharing and accessing mineral resources information in the ASEAN region. It is composed of independent modules which are the Database, Web Services and the Web Portal. A series of trial versions are presently being tested with promising results. The database module of the system is currently being updated, mainly the mineral information contents of the database, with the cooperation of the countries in the ASEAN region. The Geological survey of Japan has been conducting a series of training sessions and workshops about FOSS based database system development and Web Services following OGC standards in the ASEAN region. The main objective of these training sessions is to make ASEAN countries acquire skills in creating and maintaining their own databases, and formulate OGC based web services to serve their mineral resource data to ASSOM WebGIS portal. These human resource development activities are also very important for the creation of cheap and user friendly geoinformation platforms where people can access, integrate and analyze a wide array of data sets to make them understand the earth easily and accurately.

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