Construction of a geospatial data sharing and mutual-use by GIS technology

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Abstract

Nowadays, Japan is facing a variety of social issues, such as environmental and energy problems, maintaining and managing public infrastructure, ensuring safety and security in the community, and recovering and rebuilding from disasters, among other things. These issues are overlapping one another and are becoming opaque to the public. However, the utilization of geospatial information can help to resolve such issues. The development of geospatial information and the promotion and high level of its utilization through Geographic Information Systems (GIS) are important for achieving a society. In this paper, with advancements in information and communication technology such as the popularization of cloud computing, expansion of services through Mash up, open-sourcing, etc., GIS-based comprehensive and systemic server system that are a synthesis of individual systems and services have been developed. A framework is being developed for enabling the comprehensive searching, acquisition, development and utilization of geospatial information. A web application using Silverlight technology has been established to examine the server scalability, database accessibility, and applications of client-sides.

Key Words: *Data sharing, communication technology, cloud computing, GIS, Silverlight technology*

1. INTRODUCTION

In various natural, social and cultural environments that are conducted in those environments, diverse matters related to the land and the lives of the people involve much information about position and time, and the state when, where and how, which are treated as geospatial information. Thus, because we are surrounded by a wealth of geospatial information, we must have an accurate understanding of this information and conduct analysis to reveal complex phenomena in order to resolve a wide range of problems from the very local level to social issues (Battrick, 2006). In 2007, the Basic Act on the Advancement of Utilizing Geospatial Information was implemented. Based on this act, in April 2012, the Japanese government announced the New Basic Plan for the Advancement of Utilizing Geospatial Information. Partly due to precious lessons learned from the Great East Japan Earthquake of 2011 and in an intensive effort to recover from the disaster and reconstruct the devastated regions, there has been a growing trend recently in Japan toward the promotion of open data. In accordance with the principles set forth in the new strategy in Information and Communication Technology (ICT) and the New Basic Plan, the IT Strategic Headquarters adopted the Open Government Data Strategy set forth below as a fundamental strategy on promoting the use of public geospatial data (Open Government Data Strategy, 2002).

The local governments are responsible for formulating and implementing policies for the advancement of utilizing geospatial information in accordance with the circumstances of their respective regions based on the basic principles. However, local government holds a large amount of geospatial data which is often not shared effectively across departments and sometimes not released at all. There is also a lack of knowledge as to what data are available where and how one can access them. Implementation of better use and sharing of geospatial data and services in local government is not yet performed. Therefore, in order to promote the development, circulation and utilization of geospatial information in the region, a system for enabling the comprehensive searching, acquisition, and utilization of geospatial data must be established. Hence, the objective of my research is to perform an experimental study for geospatial data sharing and mutual-use in Fukuoka region by implementing the development and updating the geospatial information, and designing the system that enabling greater efficiency and higher quality of services in local government through Geographic Information System (GIS) and ICT.

2. RESEARCH METHODOLOGY

To achieve my research objective, the research method has been developed that consists of four-stage research processes, as follow.

2.1 DEVELOPING INTEGRATIVE SYSTEM

A research has been performed to establish a framework of a system which makes full use of the capabilities of a GIS as core system for the development, circulation and utilization of geospatial information (Fig.1). In this system, geospatial datasets provided by local government are accumulated through the designed portal site which built by the Netcommons technology.

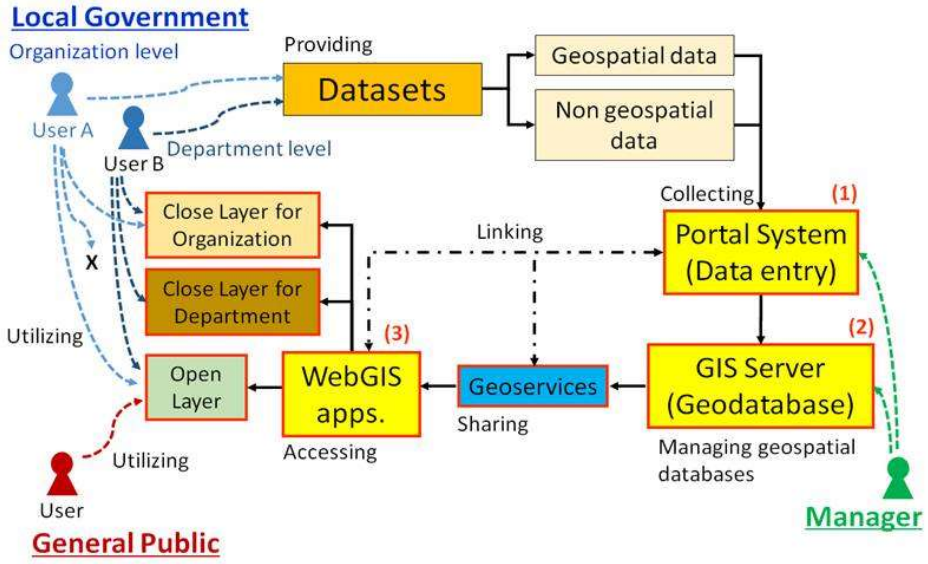


Figure 1. Framework of the system for data sharing and mutual-use in local government

A web portal is most often one specially-designed Web page at a website which brings information together from diverse sources in a uniform way. NetCommons is an information-sharing support system that provides a user-friendly environment for constructing information portals, hosted databases, document management, data entry system, and more.Moreover, NetCommons is an open source which is used in portal site construction.

It is a Content Management System (CMS) running on PHP, such as MySQL (NetCommons2).The portal site is mainly designed as data entry for local government's member users who want to integrate, upload, manage, and publish their datasets into the GIS server system.Portal site are built with NetCommons are represented as a set of pages ordered which consists of a top-page, user agreement, geoservices, data list, bulletin board, an inquiry page may be needed a feedback information. To obtain better sharing of data and services in local government, the users and data management functions are designed within the portal site. The users include manager who can manage all the functions such as update, delete, modify, etc. of the contents in the portal, member users from organizations and departments who enable to access, upload, and share the geospatial related datasets in the portal, and general public users who can access the open data services provided by local government. Member users require password authentication for organizations and departments.

In the designed system is a GIS geodatabase server, the central data storage and management framework for the system platform. Storing geospatial data in the geodatabase enables to define advanced geospatial relational models and support many multiuser workflows. Geodatabases manage a complete information model of geospatial data in heterogeneous and scalable storage environments. These include DBMSs, such as Oracle, and Microsoft SQL Server. Furthermore, WebGIS is becoming an essential component of many GIS application solutions. GIS server lets share and publish geospatial data resources on the web as geoservices. To work with these geoservices, web client applications using the web mapping for Silverlight have been developed. Silverlight enable to easily configure and deploy a custom web mapping applications to users who are not GIS profession.

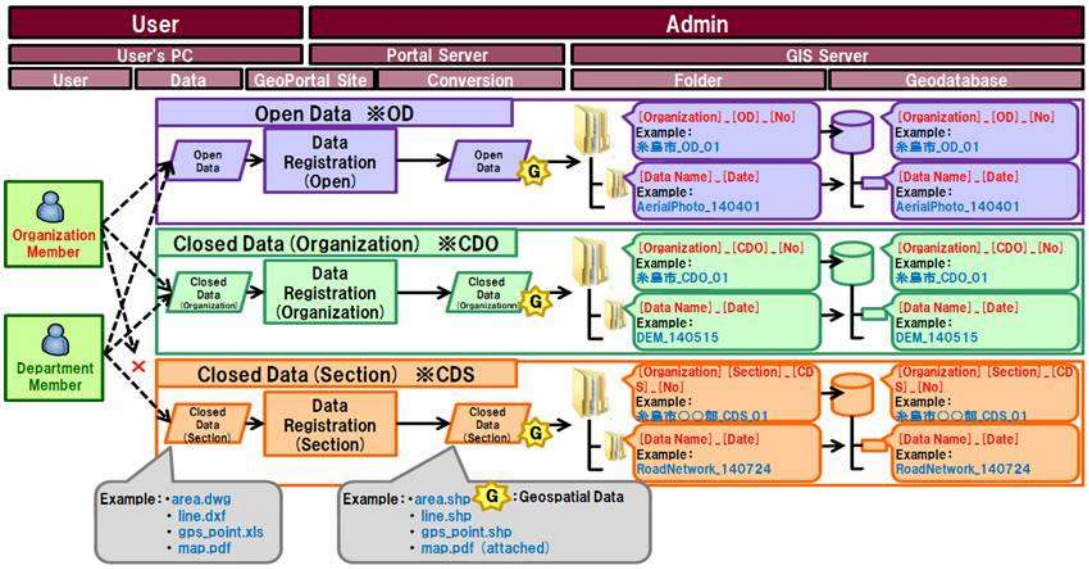
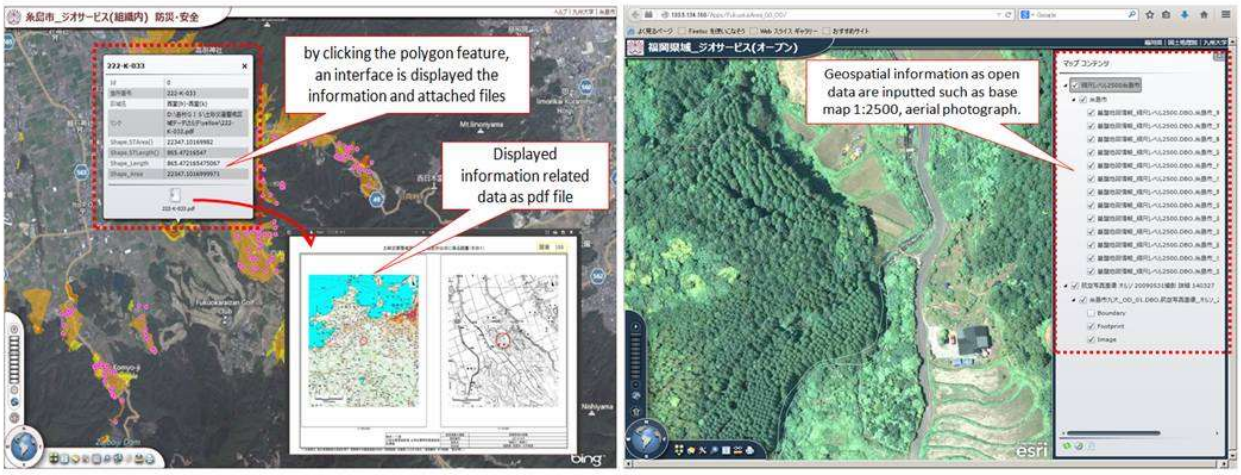


Figure 2. Multiuser (organization and department) pattern for database scheme and migration workflow



(a) Close layer model (b) Open layer model

Figure 3. Interfaces of designed WebGIS application by Silverlight.

2.2 COLLECTING, UPDATING, MANAGING THE GEOSPATIAL DATABASES

In this research, various data collection from GSI (Geographical Survey Institute) has been performed to provide the fundamental geospatial information of Fukuoka region. In particular, multi scale digital elevation data has been downloaded to provide high value of geospatial data for local government. Each geospatial theme is managed as an information set independent of other themes. Because the various independent themes are spatially referenced, they overlay one another and can be combined in a common map display. Moreover, local governments develop and store various types of data for various administrative purposes, including a lot of geospatial information datasets that is useful for many departments or for society in general. However, there is still insufficient progress being made in providing such geospatial information. It is thus necessary to digitize, analyze, and convert their datasets into geospatial information. To implement the data sharing and mutual-use of geospatial information in local government, geospatial related datasets from the government of Itoshima City have been collected, as an experimental case. Fig.2 shows the database scheme and data migration workflow by the multiuser pattern where GIS server system with a common centralized geodatabase shared among a group of member users. Registered users (organization and department) can upload their datasets through portal site by selecting the data license categories (Open Data (OD), Closed Data for Organization (CDO) and Closed Data for Department (CDS)). Organization member user can access the open data and closed data inside the organization but limited for the

closed data inside department. In contrary, department member user can access all the registered dataset by organization member. Since dataset is registered, manager can analyze, update, and convert dataset into geodatabases.

2.3 DATA SHARING AND UTIZING THE GEOSPATIAL INFORMATION

Fig.3(a) shows the interface of the designed WebGIS application as close data model for disaster prevention and safety. In this model, multiple geoservice layers are integrated such as hazard maps, photos from field surveys, and slope geometry map to give integrative information and more intelligent use of location to the disaster prevention and safety. However, the member users can only access the geospatial information and explore the related data. Moreover, the designed interface of WebGIS application as an open data model for general public is shown in Fig.3(b). Geoservices as open layers such as road, river, aerial photographs, etc. can be inputted in this application to provide better, faster, and more intelligent services.

2.4 EFFECTS OF THE USE OF DESIGNED SYSTEM AND MODELS

- The value to the policy decisions: In view of the fact that it is possible to perform superimpose of various geospatial information layers and to conduct spatial query analysis by the WebGIS application through the designed system. Consequently, the identification of the problems in the area are easily carried out by clarification of the issues by means of the visualization of overlaid distribution information (spatial data, statistical data, etc.), hence decision making can be obtained effectively. Moreover, geospatial data has been collected from many departments in local government, thus the problems across departments can be assessed efficiently.
- The value to the quality administrative services: Using the designed system (portal, GIS and web application), government staffs can quickly search the information rather than search information by manual. Member users from various departments such as emergency management, construction, and city planning department can share their geospatial data and can update their information simultaneously.
- The value to the new public benefits: Opening up data and making them accessible online for reuse to deliver better geoservices and to support a self-service approach by citizen. Greater support of self service through use of web mapping will reduce time spent by the general public finding information.

3. RESULT AND DISCUSSION

In current research, the experimental study revealed a range of benefits from the use of geospatial information within local government, such as: 1) Result of the productivity benefits associated with the accumulated impact of geospatial applications (model & database). The use of core reference database reduces costs, error and facilitates the sharing of services by referring to the same data; 2) Using geospatially-enabled information system and shared intelligence networks provides easy access to quality of information in wider area and reduces individual efforts to save cost and time to find it; 3) Wider access and use of geospatial data provides the prospect for broader engagement of local governments and citizen.

4. CONCLUSION

A system has been implemented by designing portal, GIS server geodatabase system, and web mapping applications. The designed system can provide a framework for sharing and mutual-use of geospatial information that support cooperation between and within local government. It is expected that promoting the use of geospatial information by the designed system can be applied to wider area of local governments. In addition, local governments in Fukuoka region have been encouraged to integrate and share the geospatial information between and within organizations.

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