

## DEVELOPMENT OF SYSTEM PROVIDING LOCAL AREA INFORMATION USING OPEN SOURCE WEBGIS TECHNOLOGY

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### ABSTRACT:

Recently people communicate each other about local area information using web system like “blog”. The number of people using web systems becomes increasing and users can get the information easily. The easiness on the web system is also useful for providing the local area information about a local culture, educational events, special products and so on. The locations of information are very useful to provide the information. On web system, it is easy to get information with location, but it is complicated to make the web content with the location. By using the WebGIS technologies, it becomes easier to make the contents. But the customization of user-friendly web system with proprietary WebGIS technology like as google maps is difficult because of limitations of accessibility of the source code. In this study, the experimental system providing educational and local cultural information with the WebGIS is developed using open source technology. By using open source technology, the accessibility of the source code and the flexibility of customizations of the system are improved and well-customized web system is useful for providing culture and educational materials. The experimental system is constructed on Fedora 8 that is one of the linux distributions and WebGIS is constructed with open source technologies like as MapServer, Kamap, PostGIS and Apache. The geographical information are stored in PostGIS and MapServer convert stored information to image files used in web system. Ka-map provides the user interface functions like as zoom, pan and move. In the system, two types of user are defined. One is viewer and the other is provider. The functions for viewer are search with information type, keyword search, search on the map and browsing detail information. The functions for provider are user authentication, registration of local information, registration of location of information, registration of images (photos) and edit of registered information. Example of figure shows the screenshot of our WebGIS system. In this experimental system, the educational and cultural information around Lake Kahoku were inputted in a seminar at our college and were provided. This experimental system worked well and the availability of open source technology on education was confirmed.

## 1. INTRODUCTION

### 1.1 Background

Recently, web technology is used for publishing information like as local characters, cultures and event. The number of user of the internet is increasing and the internet is useful and suitable way for users to get the information about local areas. Easiness of the acquisition of the information is worthwhile for a promotion and a condition of local area. On the other hand, it is difficult for general users to make and publish web page and the difficulties disturb the promotion of the local area using web page. Users of web system can find local area information with a search engine. In the search, almost all results are displayed using text information and it is hard for users to identify results displayed using text.

So, it is necessary for the web system to satisfy following two needs; one is that the user publishing information can input information to the web system easily, and the other is that the information searched by web system should be easy to identify for users who receive published information.

### 1.2 The Goal of This Study

The goal of this study is development of web system for publishing the local area information around Lake Kahokugata area. This system provides the understandable user interface and publishing user can input the local area information more easily and receiving user can search and find the local area information intuitively. To realize these user interfaces, we develop the system reflecting the location of information using WebGIS. The use of the WebGIS makes it possible to express the local information with both of text information and location information on the maps. The WebGIS is useful for both of publishing and receiving information about the local area.

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## 2. METHODS

In this study, almost all system, except virtual machine environment, are constructed using open source software products. Open source product is distributed with the source codes of the software and the user of the product can change and extend the software. Additionally because almost all open source products can be used for free, it is easy to distribute the developed system widely. Because of above feature, the open source software products are used for construction of the WebGIS.

### 2.1 Outline of construction of system

In this study, the system is constructed by following steps.

- (1) Setup of server environment
  - (2) Development of web applications
  - (3) Development of WebGIS
  - (4) Make of map data for WebGIS
- From next section, each step is explained.

**2.1.1 Virtual Machine Environment:** In this study, our system is constructed on virtual machine environment. The guest OS, which is different from host OS, can run on virtual machine. The reason of the use of the virtual machine is easy to construct and change the system environment. Microsoft Virtual PC 2007 is used as virtual machine software in this study.

**2.1.2 OS:** The OS, which runs on virtual machine, is Fedora 8. Fedora is one of the linux distributions and is open source software which can be used for free and changed. Fedora adopts the latest technologies aggressively and updates frequently.

**2.1.3 Web Server:** In this study, Apache is used as web server. Apache is one of open source web server and its functions are extendable with modules. So Apache has high extensional potential and is widely used for the construction of web system for not only the personal sites but also the large-scale business sites.

**2.1.4 DBMS:** PostgreSQL is used for DBMS in this study. PostgreSQL is also open source software and has a write once architecture and free data type definition.

### 2.2 Language for System Development

Languages for system development are HTML, JavaScript, CSS, PHP and SQL.

**2.2.1 HTML:** HTML is the markup language for web pages. The source of HTML in this study is built dynamically with PHP.

**2.2.2 JavaScript:** JavaScript is a scripting language, which works on web browser, and is used for building dynamic web site. The extensional library used in this study is prototype.js. This library realizes asynchronous communication in browser and is used for construction of Ajax (Asynchronous JavaScript + XML) site.

**2.2.3 CSS:** CSS (Cascading Style Sheets) is the language for describing a layout of the web page and is used for define of layout in this study. Use of CSS realizes the separation of the structure and layout of web page and becomes the trend for building web site.

**2.2.4 PHP:** PHP (Hypertext Preprocessor) is one of the scripting languages worked in web server and realizes dynamic web site. PHP changes HTML data dynamically with user's request and has high flexibility and good compatible functions with many kinds of database. PHP language is used for building server side application in this study.

**2.2.5 SQL:** SQL (Structured Query Language) is used for access of database in this study. The DBMS is processed by the SQL.

### 2.3 WebGIS

WebGIS is the technology worked on the internet and is a combination of the web system and the GIS (geographical information system). Users can operate geographical and statistical data with location on web browser using the WebGIS. The cost of the WebGIS is reasonable because user can use the GIS without special system. Figure 1 shows the construction of the WebGIS developed in this study.

**2.3.1 MapServer:** MapServer is a system for server side of WebGIS. On the MapServer, the points and shapes in maps stored in database change to the image format (raster data) that is easy to identify for a human. The MapServer is controlled from server side language like as PHP, and accesses to data on database like as PostgreSQL. The MapServer is the one of open source softwares and used for the construction of the WebGIS in this study.

**2.3.2 Ka-map:** Ka-map is the API for the user interface of the WebGIS and is produced with the JavaScript. The use of Ka-map realizes the graphical interface for movement, enlargement and reduction of maps. Ka-map controls MapServer and receives map images for displaying maps on the web browser. Ka-map also has the function for expressing the points and the lines on the maps. We use Ka-map API for realization of intuitive user interface on data produced by MapServer.

**2.3.3 PostGIS:** PostGIS adds support for geographic objects to the PostgreSQL and used for realization of the search of the spatial data.

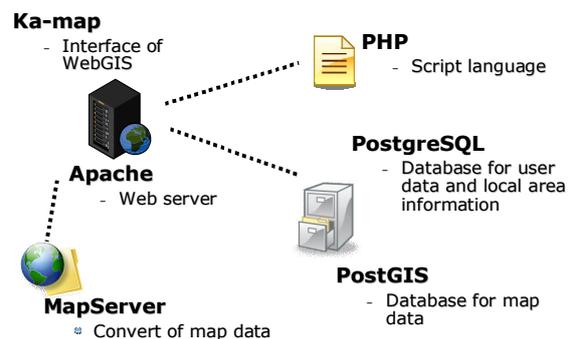


Figure1. Construction of the WebGIS in this study



Figure 2. Outline of the system

## 2.4 Map Data

The map data used in this study are digital national land information, spatial data infrastructure and fundamental geospatial data produced by The Geographical Survey Institute (GSI). These data convert to the shape file format and are registered to the database.

## 3. CONSTRUCTION OF SYSTEM

### 3.1 Outline of System

The system developed in this study provides the interfaces for the publishing user who wants to publish the local area information and the receiving user who wants to receive the local area information (figure 2). The publishing user can select the regions where the user wants to provide information. The receiving user searches the local area information with not only keyword but also location, which can select easily using GUI (graphical user interface).

**3.1.1 Function for Receiving User:** The receiving user search the local area information with specifying the category of the information, keywords and location point using GUI provided by the WebGIS. Figure 3 shows the outline of the function for receiving user. The functions for receiving user on our system are following: (1) select of the category, (2) search with keywords, (3) search with map and (4) display of define information. The receiving user can search the information, which they want to see, using function (1), (2) and (3). By using function (1), the receiving user can select the category added to the local area information for the search. In function (2), the displayed results of the search are narrowed using keywords containing in the title and the body of the local area information. In function (3), the search results in the function (1) and (2) is displayed on the map and narrowed by the location of the local area information. After search in the function (1), (2) and (3), users find the detail of the local area information by using the function (4).

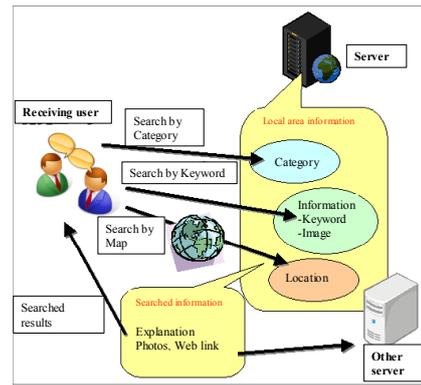


Figure 3. Functions for receiving user

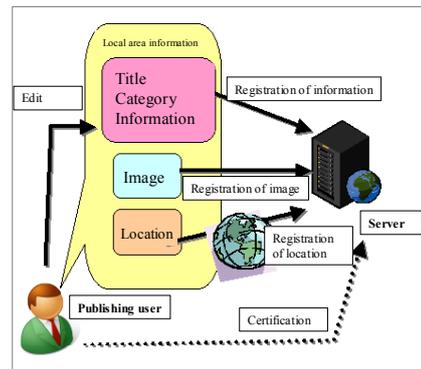


Figure 4. Functions for publishing user

**3.1.2 Function for publishing user:** The publishing user registers the local area information, that includes contents, category, location and image, and provides the local area information to receiving users. Figure 4 shows the outline of the function for the publishing user. The system produced in this study allows the publishing user to use following functions; (1) login, (2) registration of the information, (3) registration of the location, (4) registration of the image and (5) editing of the information. At first, the system certifies publishing user with function (1). The publishing user can register the local area information using function (2) and the location of the information using function (3). Finally the image about the information is registered using function (4). The information can be edited using function (5).

### 3.2 Construction of system

Figure 5 shows the construction of system produced in this study.

There are three kinds of requests from client, which are normal requests, requests for the WebGIS and asynchronous requests from Ajax. The requests from Ajax call JavaScript from web browser and request to web server with "prototype.js" asynchronously. The browser receives responses from the web server and displays the results using JavaScript without feeling any delay.

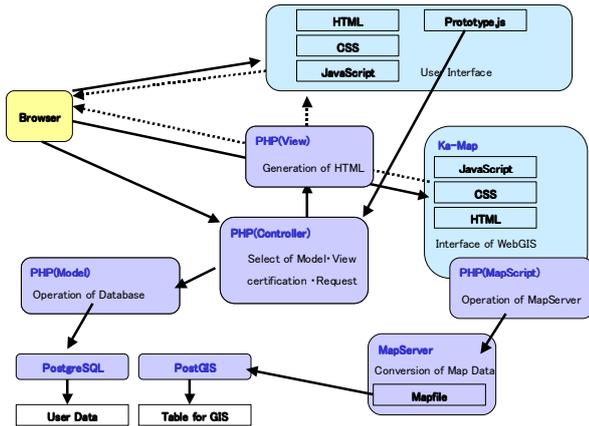


Figure 5. The construction of system

The core components of the system are processed using PHP programs that are separated by each function. PHP programs pull the local area information from the database, process the information, change the HTML contents and display the information on the web browser. The user interface of the map drew by the WebGIS in this study is constructed with ka-map and the map generation using MapServer is controlled by ka-map. MapServer accesses to PostGIS for getting the spatial data and convert the data to image.

#### 4. RESULTS

The web system developed in this study sends the local area information around Lake Kahokugata with WebGIS technology. Figure 6 shows the screenshot of the web system. The core for this system is constructed with open source softwares. The user interface in this system reduces the work for registration of the local area information. The location of the information is registered with the WebGIS. The system has the function of search with the category and keywords as shown in figure 7. Figure 8 shows the map of searched result with images and figure 9 shows the detail of the searched information. The receiving user can find the information easily with map and image about the information. This system will help to communicate regional people, find the local area information and promote the culture and cultural assets in the local area.

#### 5. DISCUSSION

In this study, the WebGIS for distribution of the local area information is constructed. The functions are separated into two types. One is for the publishing user and the other is for the receiving user. The publishing user can use the function of registration and editing of the local area information. The receiving user can use the function for searching and finding the local area information with using the WebGIS. These functions are operated with graphical user interface and both users use the system without complex operations. The system developed in this study realizes easy distribution of the local area information. Additionally the greater part of this system is constructed with open source products. It is easy for the other people to use and change the system constructed with open source products. This system can be customized according to each local situation. This system realizes efficiency distribution of the local area information with lower cost. We will be developing the system

for distribution of local area information with easier operation in the future.

#### References

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Figure 6. Screenshot of the system with the WebGIS



Figure 7 Function of search with the category and keywords



Figure 8. The map of search results with photographs



Figure 9. Detail of the information of the search result