DESIGN AND DEVELOPMENT OF WAP SERVICE
ON GEOMAGNETIC ACTIVITY

Bachtiar Anwar

Division of Applied Geomagnetism and Space Electromagnetism
National Institute of Aeronautics and Space (LAPAN)
Jl. DR. Djundjunan 133, Bandung 40173
E-mail: bachtiara@yahoo.com

Abstrak

Services based on wireless application protocol (WAP) have increased significantly during the last several years. This kind of service provides flexibility to users in browsing information via a mobile phone. LAPAN has magnetometers installed at several stations (Biak, Tanjungsari, Pontianak, Kototabang, Manado, Parepare and Kupang) that can be used to derive local geomagnetic activity index, namely k index. In order to encourage the use of the index by public, we have recently developed a service based on Short Message Service (SMS). We expand the system so that the users are able to browse or query k index of any station and date directly from a mobile phone. In developing the system, we have made use of a WAP browser to connect to Apache web server and have used PHP to generate WML scripts to provide the user a capability in querying k index to MySQL database via a mobile phone. In this paper, we report the development of WAP service on geomagnetic activity and provide some examples of the results in querying the index.

Key words: *geomagnetic activity, k index, WAP service, WML, PHP, MySQL*

INTRODUCTION

The demand for Internet access on mobile phones based on Wireless Application Protocol (WAP) has recently increasing. WAP is the standard that makes mobile Internet access possible, similar to Hypertext Transfer Protocol (HTTP) that makes possible accessing Internet via a web browser [5]. In early development, a bandwidth limitation in wireless communication requires a simple markup language, namely Wireless Markup Language (WML), for displaying web contents that conform to WAP 1.x specification. An advanced progress in wireless communication technologies leads to various capabilities for newer mobile phones. They support a high-speed wireless communication and therefore the specification was updated to WAP 2.0.

LAPAN has magnetometers installed at several stations (Biak, Tanjungsari, Pontianak, Kototabang, Manado, Parepare and Kupang) that can be used to derive local geomagnetic activity index, namely k index. In order to encourage the use of the index by public, we have recently developed a service based on Short Message Service (SMS) [1]. In this work, we expand the system so that the users are able to browse or query k index of any station and date directly from a mobile phone. The service can be expanded to include information on other geomagnetic phenomena such as anomaly in Ultra Low Frequency (ULF) related to interaction of solar wind-magnetosphere or ULF anomaly prior to earthquake occurrences. It is also possible to include information on solar activity such as relative sunspot number (R) and sunspot type which can be used to perform nowcasting or forecasting on condition of space weather [2,3,9,10]. The information can also be expanded to ionospheric anomalies or disturbances that may disturb technologies such as radio communications, navigation system as well as survey activities in geophysics [4,8].

Section 2 describes the methods used in this work, while design and development of the system are given in section 3. Section 4 provides some examples of query results using a mobile phone simulator. Section 5 gives summary of the work and the future plan.

METHODS

In designing and developing WAP service on geomagnetic activity, the following steps were performed:

1. Preparing Apache and MySQL servers on a computer with Microsoft Windows or Linux Operating System.
2. Construction of a database containing k index, users and admin tables based on MySQL server.
3. Simulated k index are generated using random numbers. This is for development purpose; it is not intended for public service.
4. Setting on Apache web server to inform WML browser on the MIME type of the incoming document, WML and WMLScript, as well as for integration of PHP and WML.
5. Construction of an application based on WML, WMLScript and PHP to query information on k index using Structured Query Language (SQL) and displays the results to mobile phone.
6. Perform testing and debugging of the system using a mobile phone emulator.

DESIGN AND DEVELOPMENT
Web design

In order to provide WAP services on space weather to public, especially k index in this work, the flow of web structure is given in Figure 1.
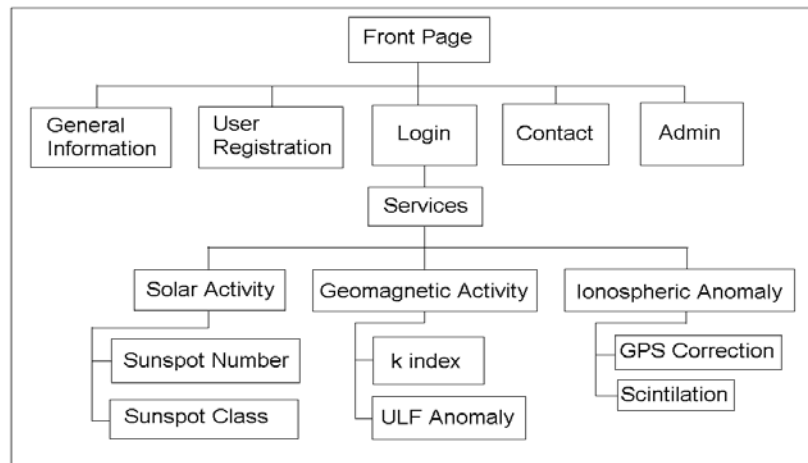

Figure 1. The flow of web structure for WAP based services to be developed. Service on k index is developed in this work, while other services will be added in the future.

Setting MIME type

We have utilized Apache web server and MySQL server for developing WAP service in this work. WAP server (not to be confused with WAP Gateway) is simply a web server with additional setting in the configuration file (httpd.conf) of Apache. It provides WAP client browser of mobile phone a capability to determine the MIME type of a file currently downloaded, such as WAP, and then displays the contents properly. The following lines should be added to httpd.conf in order to establish a web server capable of delivering WAP based service:

```
AddType application/x-httpd-php .php .wml
AddType text/vnd.wap.wml .wml
AddType application/vnd.wap.wmlc .wmlc
AddType text/vnd.wap.wmlscript .wmls
AddType application/vnd.wap.wmlscriptc .wmlsc
AddType image/vnd.wap.wbmp .wbmp
```

The service of Apache server should be restarted after updating file httpd.conf. This will force Apache to reload the configuration file to resemble the new setting.

Database design

The structure of database for WAP service on geomagnetic activity (k index) is shown in Figure 2. There are four tables: user, kadmin, kindex and kode_lokasi. Table user is used for registration the users that require information on k index or other space weather related services.
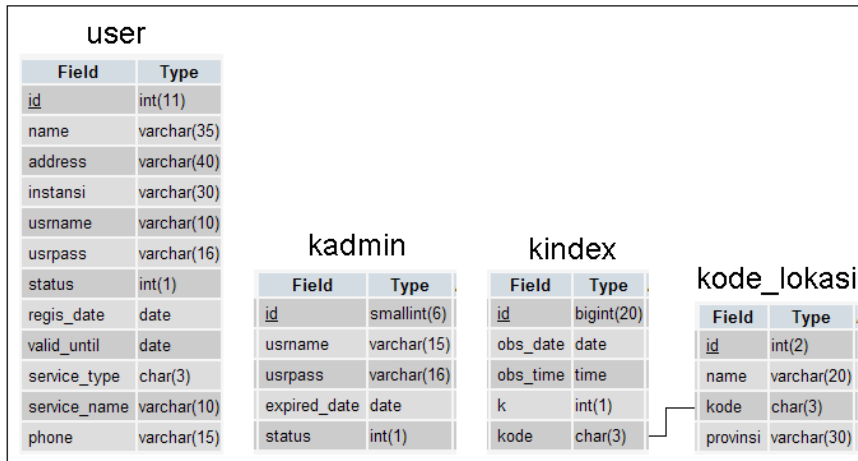

Figure 2. Database design for WAP service on geomagnetic activity.

WML and PHP Scripting

Application was written in PHP, WML, WMLScript as well as Structured Query Language (SQL) [5,6,7]. In order to provide WAP service on geomagnetic activity (k index) to public, some WML and PHP scripts have been developed as shown in Table 1.

Table 1. Some scripts written in WML and PHP along with description on their purposes.

Script Name	Purpose
index.wap	Front page that provides some hyperlinks on space weather services
ginfo.wap	General information on WAP services on space weather
regis_form.wap	Contains a step by step registration for WAP services
login_form.wap	Login page for user that has already registered to the service
contact_form.wap	Provides a form to contact to administrator
admin.wap	Login page for system administrator
service.wap	Contains hyperlinks to select a service related to space weather
solar.wap	Contains hyperlinks to select a service related to solar activity
geomag.wap	Contains hyperlinks to select a service related to geomagnetic activity
ionos.wap	Contains hyperlinks to select a service related to ionospheric anomaly
ssn.wap	Query page for sunspot number request
ssclass.wap	Query page for sunspot class request
kindex.wap	Query page for k index request
ulfanom.wap	Request for information on ULF anomaly
gpsc.wap	Request for information on GPS corrections
scinti.wap	Request for information on ionospheric scintilation
wap_query.php	An interface script to perform query into MySQL database
wmlib.inc.php	A library for managing tasks to query MySQL database

Program 1. An example of WML script showing a form for querying k index.

```
<?xml version="1.0"?>
<!DOCTYPE    wml    PUBLIC    "-//WAPFORUM//DTD    WML    1.3//EN"
"http://www.wapforum.org/DTD/wml13.dtd">
<wml>
<card>
```

```
<p>
Requesting k-index<br/>
<fieldset>
Station <select name="xstation" multiple>
<option value='-'>SELECT</option>
<option value='BIK'>Biak</option>
<option value='TJS'>Tanjungsari</option>
<option value='KTB'>Kototabang</option>
<option value='PTN'>Pontianak</option>
<option value='MND'>Manado</option>
<option value='PRP'>Parepare</option>
<option value='KPG'>Kupang</option>
</select>
Date    <input name="xdate" size="10" type="text" value="2007-01-01"/> <br/>
</fieldset>
<anchor>
    <go method="get" href="wap_query.php">
     <postfield name="search_date" value="$(xdate)"/>
     <postfield name="search_station" value="$(xstation)"/>
     <postfield name="service_name" value="k"/>
    </go>
    Submit Request
</anchor>
</p>
</card>
</wml>
```

An example of WML script is shown in Program 1. The script displays a form to request k index. A registered user is able to make a request on k index for single or multiple stations on a particular date. The default date is "2007-01-01" and can be changed by user. This is to inform the date format to be followed. The <go> tag inside <anchor> contains a hyperlink reference to "wap_query.php". This script will be executed when user presses "Submit Request" button. Passing variables for wap_query.php are provided using <postfield> tag: search_date, search_station and service_name. The values of $search_date and $search_station are provided by user's input while $service_name value is fixed to "k" for k-index service.

RESULTS
In this section we provide some examples of query results in requesting k index. After registered user successfully login into the system, user selects a service to be requested. For example, if the user selects "geomagnetic activity" and then "k index", a form for requesting k index will appear as shown in Figure 4 (left, middle). The user is able to select single or multiple stations and specify the date with "YYYY-MM-DD" format for "Year-Month-Day". When the user presses "Submit Request", a query to MySQL database is performed using keywords given by the user and requested k index will be shown. To test the system we have utilized a mobile phone simulator Openwave. Figure 5 shows a query of k index when user selected multiple geomagnetic stations.

As shown in Figure 1, the service will be expanded to other space weather services. It includes solar activity, ionospheric anomaly as well as anomaly in ULF detected by magnetometer. Solar activity represented by sunspot number and sunspot group class will be provided by Solar Observing Station at Watukosek, LAPAN. This observatory has been observing the Sun since 1987 using a sketch method. This long-term observation data is particularly useful for study the behavior of the Sun such as solar activity cycle (11 years). The data can also be used to forecast the solar activity several days to come. This is an important part of space weather since the Sun is the source of disturbances for the earth and space environment.

Figure 4. An example of query result in requesting k index from Kototabang station on January 4th, 2007.

Figure 5. An example of query results in requesting k index for multiple stations on January 1st, 2007.

Services related to ionospheric anomaly are GPS correction and scintillation. LAPAN has GPS receiver dedicated to research and its applications located at Bandung and Pontianak. Using these GPS data, it is possible to monitor condition of ionosphere. If there is anomaly, an alert can be uploaded to WAP server so that the users can browse information via a mobile phone.

CONCLUDING REMARKS

We have developed a WAP based service on geomagnetic activity as a part of LAPAN efforts to establish services on space weather to public. In this work, we have made use of simulated k index. For the actual service, the database of k index will be derived from near real-time geomagnetic data obtained from LAPAN's stations. As LAPAN Bandung plans to promote services in space weather to public, other services related to solar activity and ionospheric anomaly will be added in the future.

Acknowledgements

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