# OpenGIS Based Wireless Spatial Data Logger for Flood Mitigation

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**ABSTRACT**

*Database Management Systems (DBMS) plays an important role for decision making and mitigating disaster events such as floods. With ever increasing challenges in spatially-related managing and decision making applications, wired GIS cannot meet the demands of users for easy access to spatial data and spatial analysis. For disaster mitigation, data needs to be uploaded and retrieved from the field to minimize acquisition time frames, and remove intermediate processes that are typically required to get geographic information from the field into an application. This fosters faster processing and real time data updating*

*The explosive growth of the wireless telecommunications market has taken mobile computing to another level: wireless GIS and is offering new ways of accessing and analysing geo-spatial information on handheld devices.*

*This paper describes a prototype developed for wireless spatial data logging in real time. Spatial Data Logger (SDL) is a mobile device having proper extensions for GPS receiver and compact flash camera with capability of Internet access. Data can then be simply logged from the field and uploaded to Geo-Database server.*

*OpenGIS enables spatial data sharing and system interoperability, which leads to data integrity, timeliness and hinders data replication. Open Source softwares and freeware packages, e.g. Minnesota MapServer, PHP, PostgreSQL and PostGIS are used to develop data logger.*

*The prototype developed promotes real time data updating for flood monitoring where, Spatial Data Logger (SLD) enables field users to upload the information and view the results in near real time dimension*

*Key Words: OpenGIS, SDL, DBMS, PHP,*

## 1 Introduction

GIS architectures have traditionally focused on a static environment in which users sit at workstations to perform spatial analysis. Emerging technologies such as the Internet, wireless communication and mobile computing devices are changing the way GIS is being used by moving GIS from the desktop into field user's hands. These technologies are making GIS mobile and the operations on the fly. This project has been developed on the basis of OpenGIS specifications along with the above technologies where Web Mapping Service (WMS) produces maps of georeferenced data (OpenGIS). This project has made possible to deploy GIS on the mobile devices thus making GIS, Wireless. Since the use of and the need for different kinds of information in today's world are rapidly increasing (Christian Lundberg, 2000) Wireless GIS now will accelerate its development and ensure that the tools placed in the hands of those in the field can provide them with more meaningful and timely information.

By empowering field personnel with the responsibility of data acquisition, uploading, editing and verification, Wireless GIS applications have the capability of bringing field and office activities into a collaborative environment that can further improve productivity, reduce costs and minimize project completion timeframes.

The system developed in the paper is beneficial to use for disaster mitigation such as flood monitoring where data such as GPS, pictures and attributes can be directly uploaded from the site in real time thus making able for faster decision making.

Many organizations have developed the wireless GIS applications and softwares such as Arc Pad, MapInHand, AutoDesk Onsite etc. but less effort is given on developing the integrated system for updating and retrieving GIS data such as picture uploading, GPS and other attributes from the mobile device in real time. (prasad, 2003)

## 2 System Profile

**Table 1. Overview of System Profile**

| Software | Function |
|---|---|
| Apache Server 2.0.47 | HTTP Web Server |
| Minnesota MapServer 4.0 | MapServer |
| PostgreSQL 7.3.5 | RDBMS |
| PostGIS 0.7.5 | PostgreSQL extend |
| PHP 4.3.2 | Server Scripting Language |

| Hardware | Feature |
|---|---|
| Laser itouch P600 | Pocket PC 2002 |
| ipaq 3970 | Pocket PC 2002 |
| Compact Flash GPS | Inbuilt Antenna GPS Receiver |
| Compact Flash Camera | Mobile Device Camera |
| Extension Slot | Extension for Compact Flash cards |

The system consists of three tiers: Back-End tier, Middle tier and Front-End tier. The prototype developed is limited to point data only. These tiers and their places in the architecture are schematized as follows:

**Module 1**: Implementation and installation of a database to store geographical and non-geographical data.

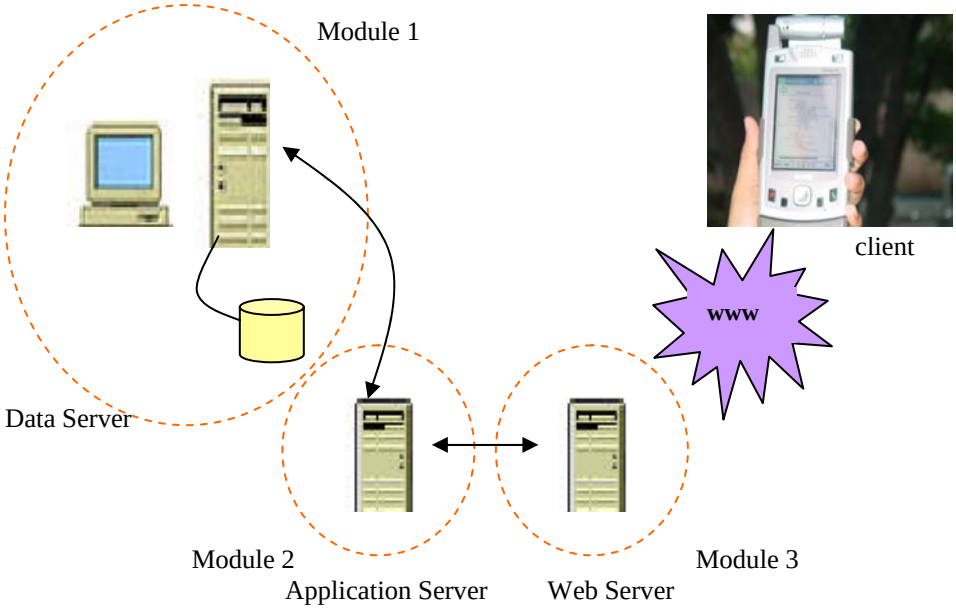



**Figure 1. Overview of the work done**

**Module 2**: Implementation and installation of application software, developed with PHP and MapServer on Linux platform, to query and data logging.

**Module 3**: Implementation and installation of a digital counter (client-web interfaces for module 2) in a platform independent environment.

## 3 Prototype Development

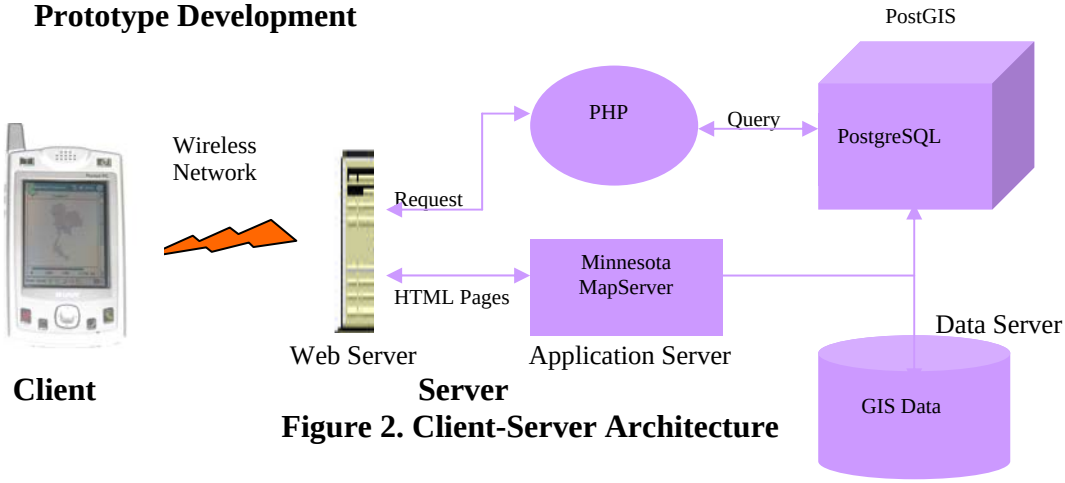
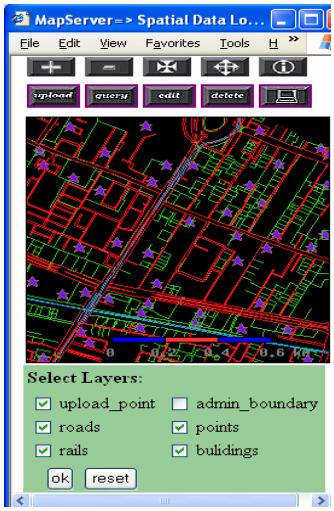



**Figure 2. Client-Server Architecture**

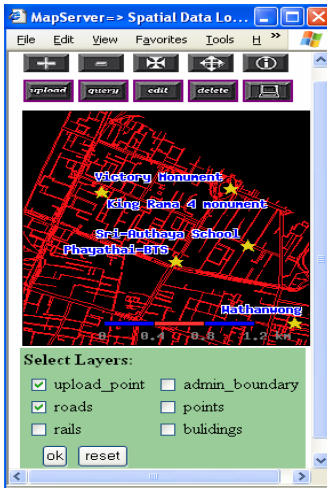
The prototype was developed using Minnesota MapServer, PHP as an application server and PostGIS/PostgreSQL as a RDBMS on the server-side application. PHP and MapServer were used to build a server-side CGI-like application for query, mapping and visualization handling. When a user takes an action, this action is passed forward through the Web Server to the MapServer. Depending on the type of action the application will generate a map or display information. The MapServer forwards the generated map to the user's browser in PNG/JPEG/GIF format.

## 4 Results

Client user interface for SDL is developed using HTML and JavaScript. Data showing layers of ratchatewi are used for testing prototype. It enables users to upload, edit and query data such as GPS, pictures and attributes using available actions everything in one click. The result can be viewed in near real time as a point in map viewer. The main feature of the system is GPS auto loading which reads the coordinates directly from the GPS and are stored as a log file in the device which can be further uploaded with pictures and attributes.




Layers of Ratchatewi Bangkok, Thailand




Points uploaded

Spatial Data Logger

**Figure 3. Map Viewer**

## 5 Conclusions

The prototype for Spatial Data Logger (SDL) was successfully developed and implemented and can be an important asset further for field data users and developing flood mitigation application.

The project conformed OpenGIS specifications to develop the prototype. Open Source softwares used in the project helped to develop a low cost SDL. This prototype thus is a freeware and can be an economical factor for the agencies and developers.

The wireless component provides the greatest opportunity for time and cost savings. By providing the mobile user with a connection to databases, the user is able to access, upload, retrieve and edit data in near real-time, thus removing the need to spend additional time, or employ additional personnel to process the data in the office.

## 6 References


Christian Lundberg, 2000. Geographic Information in Internet Related Technologies, Lulea University of Technology, http://epubl.luth.se/1402-1757/2000/52/LTU-LIC-0052-SE.pdf

Open GIS Consortium Inc., 2002. OGC 01-068r2, OpenGIS Implementation Specification, http://www.opengis.org/docs/01-068r2.pdf

Prasad R. Bauchkar, Nitin K. Tripathi, Yann Chemin, Pakorn Apaphant (2003), Open Source Solutions for Internet GIS and Wireless Data Updating. http://www.gisdevelopment.net/proceedings/mapasia/2003/webgis/index.htm

Varshney, U., Vetter, R., 2000, Emerging Mobile and Wireless Networks, Communications of the ACM, Vol. 43, Issue 6, pg. 73 to 81