

## A Model of Location Based Services for Crime Control

Roongrasamee Boondao

Vatcharaporn Esichaikul

Nitin Kumar Tripathi

School of Advanced Technologies  
Asian Institute of Technology, Thailand

E-mail: [st018512@ait.ac.th](mailto:st018512@ait.ac.th)

**Keywords:** Internet GIS, Location Based Service, Government Services to Citizen (G2C), e-Crime.

### Abstract

One of the most important roles of government is to protect its citizens from serious problems or dangerous situations. Location Based Service (LBS) can offer tremendous benefits for this area. It is appropriate to provide the government services that depend on the location of the citizen or location-specific information. This paper examines the citizen expectations in crime control system in respect to the design of electronic government service to citizen (G2C). The paper also illustrates the findings revealed from the requirement analysis of Thai police and citizens with the aim to design a model of location based services for crime control. The analysis steps start from gathering user requirements and modeling location based services for crime control from the user, security and privacy point of view.

In order to illustrate the approach, we have developed the crime control system by integrating Minnesota MapServer, Internet server and crime database into a Web based client/server environment. A number of data sets have been assembled for the project. There are two sets of data that have been incorporated. Firstly, there are the background data sets. These include police station districts, police station, road and soi (small lanes) layers. Secondly, there are data that relate to crime. These include a location of crime for example murder, robbery and gang robbery layers. The applications of crime control in the project include crime monitoring and crime analysis.

### Introduction

Electronic government-to-citizen (G2C) refers to the use of information technologies by government agencies to provide citizens with more convenient access to government information and services, to improve the quality of the services [1]. The government needs to search for a better way to utilize Information Communication Technology (ICT) to improve government works and services to the citizens. Internet technology can improve government performance, be cost effective, increase accountability, improve resource management and provide better ways of communication between citizens and the public sector. This concept has been applied to several government agencies including police work—where it is referred to as e-Policing. e-Policing is the use of ICT in police work to improve effectiveness and efficiency, support front line officers, and assist in local problem solving initiatives to reduce crime and reassure the public [2].

The safety of citizens is the most important task of the government. Location Based Services (LBS) involve the ability to find the geographical location of a mobile device and provide services based on this location information [3]. LBS can offer tremendous benefits for the safety area, for example, tracking the location of a person who needs urgent help, or of a criminal who is wanted. In the case of emergency calls (e.g. robbery, hostage, murder, etc.) it is obvious that if the call responders have information concerning the location of the people making the call, then the response time can be reduced.

This paper aims to design a model of location based services for crime control that reflects police and citizens demands. In addition, the security and privacy issues are also of concern.

### The prospects of crime control system

The requirements for the modeling of location based services for crime control are derived from questionnaires from a survey of 100 Thai citizens and 100 Thai police between May to July 2003.

According to the survey results, more than two-thirds of the respondents regard safety and security issues (emergency calls i.e. robbery, murder, theft, etc) as the primary reasons for wanting the system. They also want the system to provide information on crime for example crime warning messages, news reporting on crimes, report lost property and crime prevention information. In addition, contact information and digital maps showing the route to the nearest police station, other organizations that support victims, routes to get from one place to another and information regarding road works and accidents are also required.

With requirements gathered from the survey, the modeling concept as described by the use case diagrams [4] were developed.

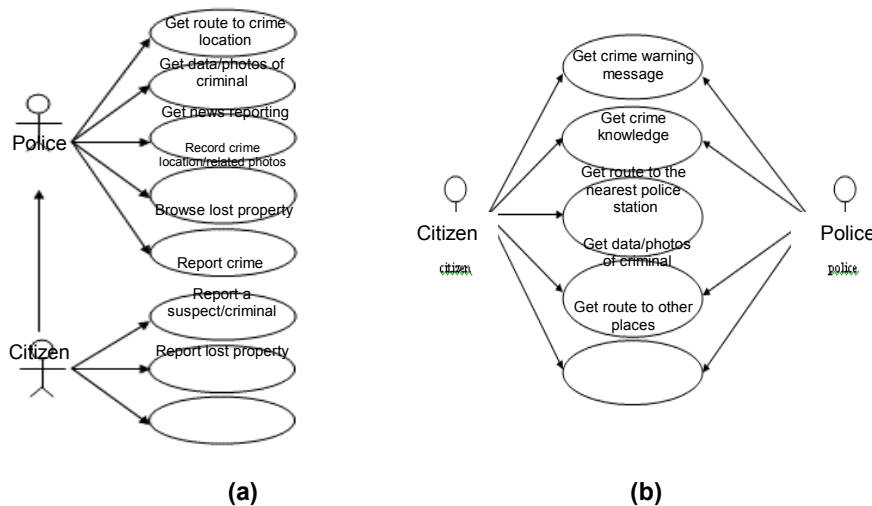


Figure 1 (a) Use Case Diagram for Crime Reporting  
(b) Use Case Diagram for Crime Information Retrieving

**Location based services model for crime control**

The users, both police and citizens, connect to the system by PDA, mobile phone, PC, etc. The system will check for the authentication and authorization [5] to identify the source of a message. Based on the security policy of the system, the authentication process can deny or allow the user to access the system. The authorization process is used to control access to resources once identity has been verified. Then the data will be obtained by data analysis and converted to longitude and latitude and sent to the database. The database consists of crime data and GIS data which will be integrated before sending to the server. The HTTP server/Map server/WAP server will do the computation. The Web browser/WAP browser is used for viewing the results.

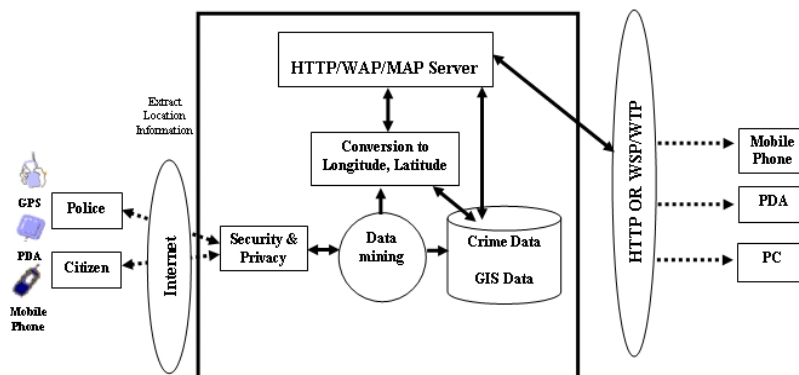


Figure 2 Location Based Services Model for Crime Control

### Privacy issue

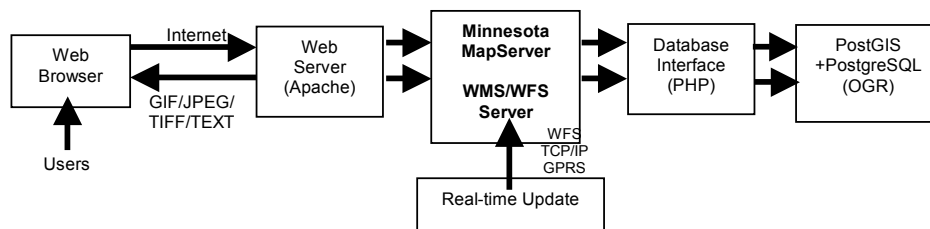
Privacy is an important issue in a public information system. The location of a person may be a piece of sensitive information, especially when this is clearly identified with a time. Therefore, mechanisms must be devised to ensure privacy protection. Also, sufficient information must be available to the system to answer queries. The solution to this problem is the anonymous person policy. The system preserves information about each person but removes the identification of the person. This anonymous information can then be extracted to generate the aggregated information. The person identifications are only kept during the query computation and destroyed immediately afterwards, leaving only enough information for crime statistical purposes. However, this privacy policy is only applied to cases not involved with crime events; for example finding the nearest police station or hospital, or how to get from one place to another, etc. In the cases involving crime, it would be important to keep the person identifications for crime analysis purposes but this information should only be available to authorized personnel for investigative purposes.

### System Development

We have developed the crime control system by integrating Minnesota MapServer, Internet server and crime database into a Web based client/server environment. The MapServer [6] is a system for developing web-based GIS applications. The core of the system is a Common Gateway Interface (CGI) application that allows developers to rapidly build and deploy web applications based on GIS databases using simple text-based configuration and presentation templates.

The PostgreSQL [7] database server has been used to manage the attribute data and multi-media content. PostgreSQL is an Object-Relational DBMS, supporting almost all SQL constructs, including sub-selects, transactions, and user-defined types and functions. The database consists of tables that hold all the attribute data and spatial data. The PostGIS adds support for geographic objects to the PostgreSQL object-relational database. In effect, PostGIS “spatially enables” the PostgreSQL server, allowing it to be used as a backend spatial database for geographic information systems (GIS). Real-time update of authorized users is also made possible. An authentication and authorization mechanism to check which users can be allowed to enter new data or update the existing database is also provided.

The users can access the system by web interface (PHP) that enables online access to the GIS layers and attribute information.



**Figure 3 Components and Information Flow**

### Conclusion

In this paper we presented the requirements of a crime control system that is derived from users demands. We illustrated a model of location based services for crime control. We also described the features of the system that we are employing to guarantee user privacy and security. Most of the research presented in this paper is still a work in progress. We are currently implementing our model. In the near future, we hope to access the performance of our model on a very large group of user who are behaving in a very realistic manner.

### References

- [1] World Bank's e-government website (2001). A Definition of E\*Government. <http://www1.worldbank.org> .
- [2] Woods, P. (2001). e-Policing. <http://www.e-policingreport.com>.

- [3] Prasad, Maneesh (2002). Location based Services.  
<http://www.GISdevelopment.net> .
- [4] Kulak, Daryl, Guiney, Eamonn (1998). Use Cases Requirements in Context. Addison-Wesley, New York.
- [5] Garfinkel, Simson, Spafford, Gene (1997). Web Security & Commerce. O' Reilly & Associates, U.S.A.
- [6] MapServer. Mapserver home page.  
<http://mapserver.gis.umn.edu/> .
- [7] Raghavan V., Santitamnont P., Masumoto S., Honda K. (2002). Implementing Web GIS Applications using Open Source Software.  
<http://www.GISdevelopment.net> .