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## Research and Development of Geographic Information System Application to Implement Khlong Saen Saeb Communities' Environmental and Educational Activities

S. Saifah<sup>a,\*</sup>, S. Phoomkokrux<sup>b</sup>, S. Wongkumsin<sup>c</sup>, S. PiriyaSmith<sup>d</sup>,  
S. Songmuang<sup>e</sup>, O. Ratanasinchaiboon<sup>f</sup>

<sup>a</sup>Graduate School, Kasem Bundit University, Bangkok, 10250, Thailand

<sup>b</sup>Department of geography, Faculty of Arts, Silpakorn University, Nakornpathom, 73000, Thailand

<sup>c</sup>Faculty of Engineering, Kasem Bundit University, Bangkok, 10250, Thailand

<sup>d</sup>Graduate School, Kasem Bundit University, Bangkok, 10250, Thailand

<sup>e</sup>Faculty of Science and Technology, Kasem Bundit University, Bangkok 10250, Thailand

<sup>f</sup>Department of geography, Faculty of Education, Ramkhamhaeng University, Bangkok, 10240, Thailand

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### Abstract

This research aims to collect and analyze the demands of utilizing the Geographic Information System (GIS) in order to support environmental study of the activities of the communities along Sean Seab canal. Furthermore, this study also examines the working diagrams of the GIS program service packages, to design and develop relationship of the diagrams regarding systemic database on the GIS, and to develop applied GIS program in order to support relevant activities of environmental studies, regarding the communities along Sean Seab canal. The research outcomes found that the specification of GIS program should be developed on the basis of the Web-Application, which, when eligible, should be applied as a Client-Server that can share and collaborate databases within the GIS program. Likewise, the Management Information System (MIS) was also developed from the Open Sources (Freeware) platforms that operated either on the internet or on a personal computer. This system, moreover, exerts the two-way communication and backup system that could improve any applied GIS programs such as the Minnesota Map Server and MySQL for connecting certain information and working procedures that are developed from PHP Platform. HTML is also developed in terms of transferring data between computers and servers.

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**Keywords:** Geographic Information System, Minnesota Map Server, Web-application, relational databases, database, MySQL, Client-Server, Open Source, Freeware

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\* Corresponding author. *E-mail address:* [notekbu@gmail.com](mailto:notekbu@gmail.com)

## **1. Introduction**

With the collaborative research agreement between Srinakarinwirot University and Kasem Bundit University, this study was to discover the qualities of life and the environments of San Seab canal's communities between 2010 and 2012. The researchers aimed to study and collect in the methodologies of quantitative, qualitative, and experimental paradigms in seven arenas.

1. To study conservational awareness of Sean Seab canal
2. To study developmental awareness of San Saeb Canel's environments
3. To study quality developments of community's health and sanitary
4. To study economic developments of communities
5. To study cultural and architectural conservation of communities
6. To develop applied programs of information technology for supporting environmental activities of communities

This study was entirely in the second phases of the research project in developing information technology for supporting environmental study's activities of Sean Seab canal communities. Furthermore, the first phase successfully discovered the developments of geographical information system in supporting environmental study's activities of Sean Seab canal communities. The document analysis found that Sean Seab canal was purposefully built for strategic orientation, communication, commercial activities, agricultural service, and people utilization. Moreover, this canal has been connected to the major rivers and canals in that area. Thus, the characteristics of canal created the inhabitants along this area, which are rich in architectural uniqueness.

The route of Sean Seab canal can be divided into 3 parts, which are the South Sean Seab, the First North Sean Seab, and the Second North Sean Seab, About the south Sean Seab, originally built in the era of King RAMA I, it starts as connector Mahanark Canal straight down to Huamark area (New Petchburi Road and Kampangpeth 7th Road), near by the Ramkamheang Airport rail-link station. This route is about 9.1264 kilometers. The First North Sean Seab, originally built in the era of King Rama III by the Chinese labor, to connect Bangpakong River, this route is about 53.519 kilometers from Huamark area to Bang Kanak area. Additionally, the second south Sean Seab route was also originally built in the same era with 9.88 kilometers long. However, King Rama V suggested expanding the canal from 12 meters to 16 meters in order to increase proficiency in transportation and flood relieves.

The scope of this research has specified only Sean Seab canal's communities within 1 kilometer from the middle of canal in the entire route, thus the researcher can perceive all activity, including water consumption or environmental conservation. The data collection process included document analysis method and field-study, in order to make 24 layers of geographic information system; for instance, demographic, economic, and grounded social data, which needed to support environmental study activities of Sean Seab canal communities. Moreover, the benefit of using computer program in GIS (Geographic Information System) is to facilitate skilled and unskilled users to retrieve particular data. In essence, the research can develop an applied program in geographic information system to present and collect subjective data, and, moreover, the program can simplify process in managing data efficiently and sustainably.

## **2. Research Objectives**

1. This study was to collect and analyze the demands of geographic information system to support activities of environmental studies of Sean Seab canal Communities.
2. This study was to design and develop work diagram of geographic information system.
3. This study was to design and develop relationships among geographic information system's database.
4. This study was to develop an applied program of geographic information system in order to support activities of environmental studies of Sean Seab canal Communities.

### 3. Scope of Research

This study utilized the data of geographic information system from the first phase, which is focused on the areas within 500 meters from the canal's center. The researchers divided the canal into four parts, Bangkok's inner area, middle area, outer area, and Chacheongsao province's area.

### 4. Research design

1. Brainstorming various ideas from co-researchers to set information design with the applied geographic programs based on the program's specification from the outcome of the research's first phase.

2. Setting the program qualification and database level of the geographic information system programs regarding

- a. Details of data presented in the program
- b. Data characteristics in the program
- c. Filing system in the database
- d. Data's presentation
- e. Data's retrieving process
- f. Database's simulation
- g. Data analysis
- h. Data connection and transfers
- i. Program reporting
- j. Data's layers of geographic information

3. Designing working diagrams of the program and the relationship of certain factors in database by utilizing agreements from researchers' consortium to create the working diagrams.

4. Developing applied geographic information system to support activities of environmental studies of Sean Seab canal Communities

5. Proceeding assessment and application of the applied program of geographic information system in the simulation database at Kasem Bundit University and sharing this program to the public in order to evaluate its performance.

### 5. Research Tools and Methodology

1. Computer with the geographic information system's program for amending the Geographic information system's data

2. Scanner size A0 for mapping data

3. Topographic Map of Sean Seab canal L7017 with 1:50,000 scale for navigating more investigation

4. The high definite satellite views of Sean Seab canal with 500 meters widen coverage from the canal's central point

5. The Global Positioning System (GPS) determining important point of interests to construct the geographic information map

### 6. Research Outcomes

1. Developed program's specification

The researchers found the program's capability that well-worked collaboratively with actual demands from the research first phase; for example, the program was developed as the Web-Application basis, Client-Server, shared database, and well-connected between GIS and MIS. Furthermore, this program was also developed from the Open-Source or Freeware that can work together on network, internet, and personal computer, because of its two-way communication system and data-backup system.

## 2. Program details

- a. The Management Information System (MIS); such as, districts, provinces, activities, knowledge management, complaints, and web-board.
- b. The Geographic Information System (GIS); such as, data layers of satellite, buildings, governed area, city plan, important places, transportation, canal, and Sean Seab canal

## 3. Program development

The program development was derived from brainstorming ideas in areas of geographic information system and database system.

- a. The geographic information system development for harmonizing the program demands. Thus, this research was successful in designing an applied program structure with three major components, as in figure 1.

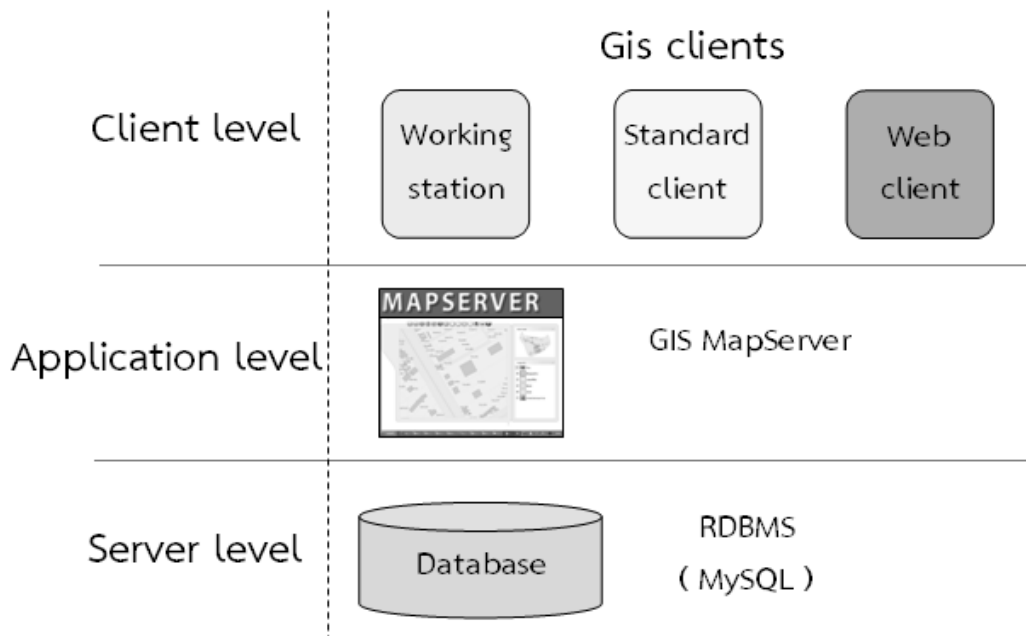


Fig. 1. Applied program of geographic information system structure

From figure 1, the researchers can approve that program development can be progressed via the Web base platform, that all users can reach different databases and utilize all of them in the same time, based on the nine categories of program qualification. Moreover, the structure of program architects has been divided into three major parts which are clients in terms of internal and external users, local administrators, and GIS map server. The program was developed from the PHP, JAVA script and html, however, GIS also utilized the Minnesota Map Server; meanwhile, descriptive data was proceeded by the MySQL, because it worked properly as a freeware that could be developed as program architecture in figure 2.

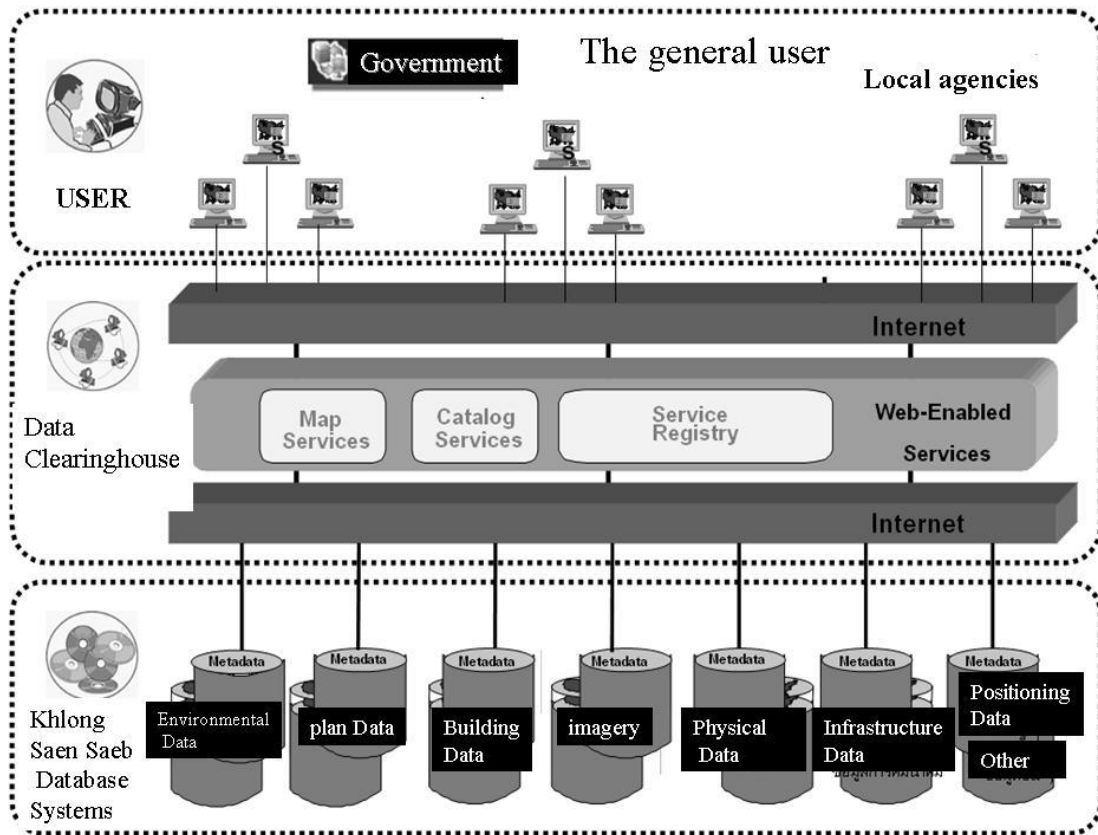


Fig. 2. development of Architectural structure of the geographic information system

From figure 2, the researchers designed the program architectural structure related to the program specification, which are presented in six steps. The first step is when there is demand from particular Client Server, the program will monitor and simultaneously run the PHP file in the Server. Second, the Server itself will search PHP file based on Client's requests; after that, the system will assess PHP file's results, then the system will connect the database and start evaluation process. Sixth, the system will submit an outcome to groups; however, the developed system could be well worked in the Stand Alone and Network platform.

#### 4. The relationships among different factors in database (ER-Diagram)

According to the researchers' agreements, this research can be applied as template in designing relationships among different factors in figure 3.

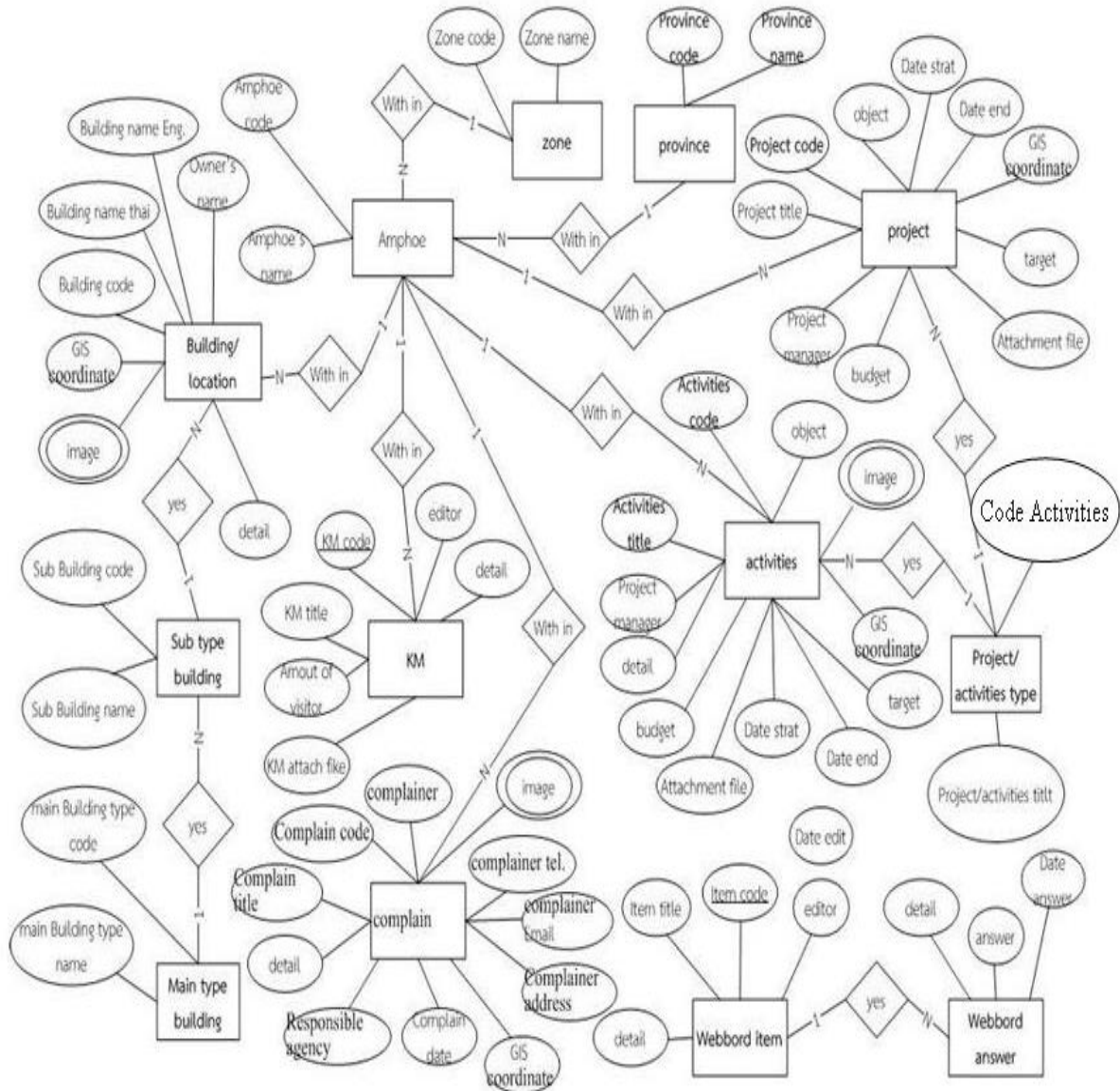


Fig. 3. Relationship Diagram (ER-Diagram)

From figure 3, the researchers explained coverage and abilities in designing database to support certain activities of environmental study of Sean Seab canal communities in nine points. 1) Building and location (name, code, positioned spot, pictures, general information and owner’s name), 2) District information (name and code), 3) Zoning information (name and code), 4) Province information (name and code), 5) Project information (name, code, project objective, project duration, positioned spot, expected target group, authorized person, budgeting, and attached files), 6) Activity information (name, code, objective, activity period, activity’s positioned spot, expected target group, authorized person, activity budget, attached files, and activity’s pictures), 7) Knowledge management information (name, code, knowledge practitioner, knowledge content, activity attendants, and attached files), 8) complaint information (name, code, complained person, complaint detail, authorized officers,

complained date, complained positioned spot, attached pictures, and complained person's contact information, and 9) Web board information (topic name, code, poster, recipient, and posted date).

#### 5. Applied program of geographic information system development

The researchers found the application to develop geographic information system in order to support various activities of environmental study for Sean Seab canal communities, designing program details in 17 areas; such as start-up process, satellite views, snapshots, and GIS, Web board, summarized paper, searching tools, registration, log-in, log-out, building information supervision, activity management, complaint control, knowledge management, project management, GIS and satellite view's layers, data retrieval, summary reports, and web board application.

#### 6. Assessment of developed GIS program

The research team has set and installed the GIS program in simulated computer network at Kasem Bundit University in order to run and estimate experimental procedures. The experimental outcome found that this program could be well-harmonized with Internet Explorer 7, Google Chrome; however, working on Opera, Mozilla Firefox, and Internet Explorer 8 needed to be further developed.

### 7. Implication and Recommendation

From all research processes, the researchers agreed from evidences found at the research site regarding appropriated factors in designing database to support activity of environmental study of Sean Seab canal's communities. Moreover, the researchers also drew pictures of program qualifications and geographic information layer in running program result process. The result has covered related activities and projects occurred in the Sean Seab canal communities; additionally, the programs can support any feedbacks, thoughts, and opinions about canal utilization in order to develop community's environment in the future. Regarding working diagrams and factor related diagram, the researchers found that this developed program must be improved in terms of feedback systems for each program module, which influences authorized person to perceive any opinions and further recommendation from actual users of each project or issue uploaded to the system. Likewise, this GIS development also well collaborates with the Web-browser; such as, Internet Explorer 7(IE7), and Google Chrome, but have rather limitation in working with Internet Explorer 8 (IE8), Opera, and Mozilla Firefox. The research team will enhance subjective recommendations from related specialists to further improve in the next phase.

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