

DEVELOPMENT OF A SIMPLE WEB-BASED GIS SYSTEM FOR SUSTAINABLE HOUSING PROJECTS VISUALIZATION

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Abstract. This paper presents a simple web-based GIS system for visualization of Baan Mankong, as known as sustainable housing projects for communities of low-incomers in Thailand. The Baan Mankong project has been so successful that numbers of projects initialized have been increasing during the past couple of years. The projects information is gathered in a huge database, but there is a lack of visualization tool to help the officers and executives to have a global view of the projects' spatial distribution and to have a quick access to project information. GIS is proposed as a tool to be developed on the web for the visualization of this project. The Baan Mankong's work flow and project information are studied in order to select only necessary information to be stored in the system. Then, the geographic visualization tool development process is presented.

Keywords. GIS; Google Maps; sustainable housing; project database

1. Introduction

Baan Mankong or "sustainable housing" is a project under supervision of The Community Organizations Development Institute (CODI - Public Organization), Thailand. Began in 2003, the project aims to solve problems occurred in communities of low incomers living in the cities throughout Thailand. The development target concerns 3,750 communities, 1.14 million households, 5.13 million people. People in these communities live in high density area, in precarious conditions, and usually have problems of land intrusion. The communities are encouraged to consolidate in terms of saving and fixing a common aim to improve their living environment. After having sufficient saving money, they can design and build their own house on a piece of land with help from Baan Mankong. The community will get the loan and will be partially funded by the government for the construction of public facilities.

The Baan Mankong project has been so successful. The numbers of projects initialized have been increasing during the past couple of years, with the objective to construct more than sixty-thousand units per year. The projects are geographically distributed across the country, 76 provinces in 7 regions. The projects information is gathered in a huge database, but there is a lack of visualization tool to help the officers and executives to have a global view of the projects' spatial distribution and to have a quick access to project information. This paper presents the development process of this tool. The tool could also help improving the project's development strategies. Baan Mankong is community-based projects, where success cases are used to demonstrate and convince the future ones. Containing different case studies, it can be useful for project presentation and communication. Even though the development process is specific for each project, its data share the same characteristics, such as project name, location, development status, development scheme, site pictures, etc.

Considering these characteristics, GIS (map + database) is proposed as a tool to be developed on the web for the visualization of this project. For the economic reasons, various web-based public cartographic engines are reviewed.

2. Literature review

2.1 Review of public cartographic engines

At present GIS computer applications or software in terms of cartographic mapping system has been divided into two main types: close application or proprietary software and Open Source software. These two types could be employed in the stand alone environment or web base environment. However, we will uniquely focus on web-based public cartographic engines. The following details will briefly describe, compare and select the existing cartographic mapping software for using in the study.

2.1.1 Google Maps

Google Maps (cf. Figure 1), formerly Google Local, is a free and user friendly web mapping service application, the technology provided by Google. It provides public: directions, interactive maps, and satellite/aerial imagery of the United States and the rest of the world. Google Maps can access via any web browsers without additional program installation. The most important aspect of Google Maps is providing the API or application programming interface to integrate the map tool on any website at no cost. The Google Maps API allows the users to embed Google Maps in their own web pages with JavaScript to manipulating maps, adding content and variety of services. (<http://www.google.com/apis/maps/documentation/index.html>)



Figure 1. Google Maps

2.1.2 Yahoo Maps

Yahoo Maps (cf. Figure 2) offers the same kind of services as Google Maps, including the Maps APIs. However Yahoo Maps try to make its services more specific, variety and easy to use such as **Yahoo! Maps Simple API** which let users easily overlay map data without programming knowledge. The quality, map details and localization is not comparable to Google Maps. (<http://developer.yahoo.com/maps/>)

2.1.3 Virtual Earth

Virtual Earth (cf. Figure 3) is Microsoft owns platform expecting to be the next generation 3D mapping and location service. Virtual Earth has started service in May 2005. It combines the MapPoint Web Service with new innovations around bird's eye, satellite and aerial imagery, map styles and usability as well as enhanced local search or in other word a hybrid program of Google Earth and Google Maps. (http://www.mapping-tools.com/info/mp_products/virtual_earth.shtml)

2.1.4 *SmartMap*

SmartMap (cf. Figure 4) formerly MappointAsia, is a specially designed Desktop Mapping software package using MappointAsia’s fast-display Map Engine. At present the service is cover only in Bangkok, some major provinces in Thailand and Malaysia. This required installation web application is proprietary type software developed in Thailand and has the features similar to Google Earth.

(<http://www.mappointasia.com/products/smartmap.asp>)

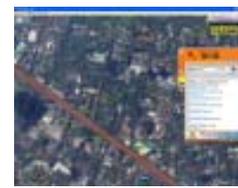


Figure 2. Yahoo Maps

Figure 3. Virtual Earth

Figure 4. SmartMap

2.2 CASE STUDIES

2.2.1 *Neighbourhood Information Systems (NIS)*

NIS or Community information systems (cf. Figure 5) is web base system for distributing valuable community and social indicator data to concerned individuals, social service organizations, community development professionals, policy analysts, planners, and businesses who would otherwise have great trouble accessing neighborhood level data. Social scientists use this tool to learn and understand social and built environment. NIS was developed by the Cartographic Modeling Lab (CML) at the University of Pennsylvania in 1998. The main component is GIS software and the network of World Wide Web. However information in the system is covering only the area of Philadelphia.

(http://www.gisdevelopment.net/application/miscellaneous/mis002_1.htm)

2.2.2 *Chiang Mai Interactive Map for Thai Tourism C-Commerce*

An interactive map of Chiang Mai was developed by the Software Industry Promotion Agency (SIPA) and Thai Tourism Collaborative Commerce or Tourism c-Commerce (cf. Figure 6). SIPA, a governmental unit has developed a central Tourism c-Commerce network to help increase the proficiency of travel suppliers by using ICT (information and communications technology), its Chiang Mai Tourism c-commerce website employs the interactive map by utilizing the mapping system from Google Maps. The map functions are very simple just for searching the locations and viewing the information only. The information display is pictures and list of locations such as hotels, and tourist attraction places.

(http://www.chiangmaitcc.com/LZ_TTCC/index.jsp)



Figure 5. NIS

Figure 6. Chiang Mai interactive Map

2.2.3 Construction of a dynamic environmental knowledge web for a sustainable environmental design

This is a research work by Atsuko Kaga, Hahm Joohyung and Tomohiro Fukuda published in CAADRIA 2007. The main theme of the research is creating an environmental knowledge web site with mapping tool (Google Maps or Google Earth) for the user to participate in discussing the ecology, environment and sustainable issues by submitting their information such as pictures, description and position or location of that information has occurred.

2.3 SELECTING COMPARATIVE CRITERIA/FACILITIES.

Table 1. Comparative criteria/facilities.

Selecting Comparison criteria					
Name	Google Maps	MapPoint	Virtual Earth	Yahoo Maps	SmartMap
Client install required	no	no	yes	no	yes
Web base app.	yes	yes	yes	yes	yes
Stand alone app.	no	no	no	no	no
Embedable	yes	no	no	no	no
Popularity	best for public	business	public	good	business
Protocols	JavaScript	proprietary	proprietary	REST	proprietary
Cost	free	partial	partial	free	license
3D or 2D	2D	2D	3D	2D	3D
Localized	yes	no	no	no	yes
Modes	S,M,H,C	M	S	S,M	S
Browsers	any	any	IE	any	none
Supports	good	poor	poor	average	poor
Security	developer key	NA	NA	developer key	NA
API provided	yes	no	no	yes	no
map quality	good	average	good	average	good
customizable	yes	NA	NA	yes	NA
learning curve	easy	average	easy	easy	average
map cover areas	world	US,Europe	US	US,Europe	Thai, Malaysia

facilities.

S = satellite
 M = map
 H = hybrid (satellite and text)
 C = Custom map
 NA = not applicable
 IE = Internet Explorer

The selecting comparison criteria table (cf. Table 1) has indicated that the suitable software for using in the study is Google Maps with the following advantages: no cost, customizable, good support both from Google and the user community, learning curve is very low (both users and developers), accessible from anywhere with browser, no installation, the functions or API is sufficient for supporting the purpose of study to store the locations and the most important is Google Maps has and still keep on developing more and more comprehensive map information for Thailand.

3. Developed system

3.1 DEVELOPMENT PROCESS

The development process consists of analyzing

- (1) Baan Munkong management system, including CODI organization chart, Baan Munkong organization chart, workflow and Baan Mungkong regional divisions,
- (2) the existing project information using pilot projects in 12 communities throughout Thailand. As a result, a diagram showing information occurred in Baan Munkong development process was summarised. The information is categorized and filtered into only necessary ones for project management. Also, this analysis allows us to summarized a typical development process of Baan Mungkong even though the process varies from province to province,

Then a project visualisation tool for efficient information management is proposed, with following characteristics:

- (1) Information access by map,
- (2) Database,

- (3) Web-based interface for data display and manipulation,
- (4) User type and access control.

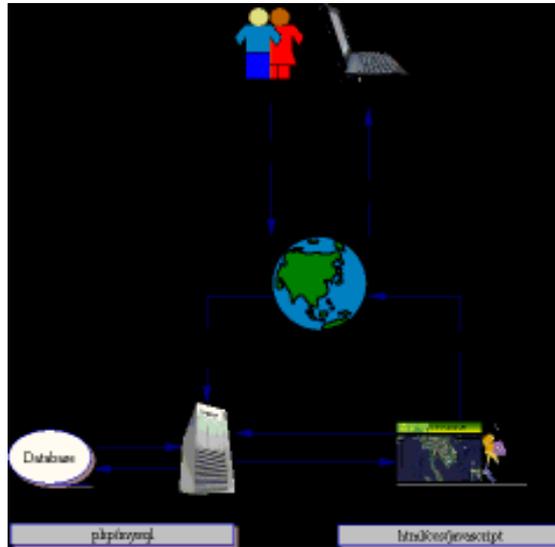


Figure 7. System Configuration (Data flow diagram)

3.2 SYSTEM CONFIGURATION

The geographic visualization tool development process uses Google Maps API running on javascript and Ajax, php, MySQL database and apache server (cf. Figure 7). The components developed are:

- **custom maps**: a special map is added to the interface and colorized according to Baan Mankong's geographical organization,
- **map cascading menu** allows changing the map view (region => province => project),
- **project database** recording essential information for the project management, presenting in form of markers,
- **markers choosing by colour**: it allows the user to view the project according to its progress status, distinguished by different colours (all status, not-begun, under preparation, under progress, finished, and suspended)
- **users access control**: users are divided into four groups (public, officer, executive and administrator),
- **zooming tools** using Google Maps API are applied,
- **image gallery** allows the officers to add and visualize the project's images,
- **project search tool** allows the user to look for projects using a filtering tool,
- **Executive summary** summarizes the project information and presents it to the executives.



Figure 8. Application interface

3.3 MAP CREATION TECHNIQUE

Google Maps has allowed public users under few conditions to embed and extend some functions into user web page. One of them is custom map function which other map services do not provide. The study has taken this advantage by embedding the map and custom map function with the purpose of helping user of the web site of the study (Baan Munkong) to find locations in Thailand easier. Since the Baan Munkong Authority has assigned the working area specifically for their usage only, the custom map function therefore will be a great assistant and quicker in locating the community site and store this information for future reference. There are some points to observe when making the custom map;

1. Google Maps has four modes of map display: map, satellite map, hybrid map (satellite map with text) and custom map which the button modes can be selected shown.
2. All maps shown on screen are composed of many small map tiles at the size of 256 by 256 pixels no matter how far or close of the maps.
3. Zoom levels of map divided into 18 levels, 0 level is the farthest (shown the whole earth) and 17 level is closest (the scale is approximately 1: 5,000).
4. The process of making custom map consists of the following steps;
 - Decide the area and zoom level for making the custom map.
 - Obtain or making the map at the desire scale.
 - Cutting the map into small tiles with size of 256 by 256 pixels for each tile and assigned the ID.
 - Each map tile saves as a single image file.
 - Writing the JavaScript to run the custom map and add into the web site HTML code.
 - The custom map can be rendered in unlimited ways.
 - The ID or map tile image file name should be strictly followed the naming of Google Maps API.
 - The collection of the custom map tiles can be stored at the web site server; it does not need to upload to store at the Google Maps servers.
 - In case of, the custom map need to overlay on the Google map for the purpose of getting the location latitude and longitude, the ID of custom map tile must correspond to the Google map tiles.

- The custom map could be made only in a limit of area and scale because of the storage disk space for the whole earth with all zoom levels and all modes will take about 217.812 TB (per mode) times 3 or 653.436 TB (terabyte).

3.4 USER TYPE AND ACCESS CONTROL

Because of Google Maps required condition for all web sites that embedded Google Maps must not restrict the access to general public; therefore the web site of the study has divided level of access to the map functions into 2 levels:

Level 1 for general public to view map in all modes, including custom map mode.

Level 2 for registered users with password, which are classified into 2 groups;

- First group is the general public, after their visit the study web sites home page (Baan Man Kong) showing the Google Maps and some other information and want to learn more, *they* can register and allow viewing some detail of success works of Baan Man Kong project.
- Second group is for Baan Man Kong personnel, comprise of 3 types; *Executive* which could only view all data and report from database but not allow to edit data, *Operation staffs* could view, input and edit the data and *System admin* could view the data and manage the access for the registered users.

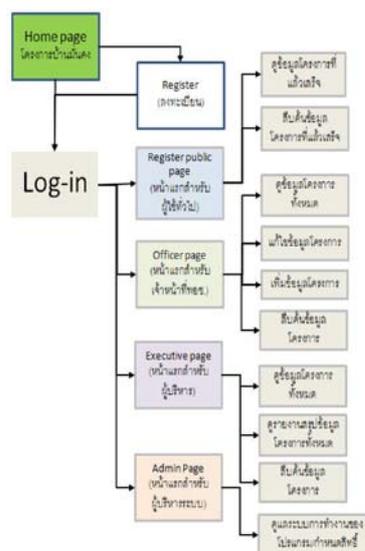


Figure 8. User Type and Access Control

4. Evaluation and Future work

The problem encountered in the development process is the limit of web browser. The tool is completely developed and is currently under test stage. From the developer’s point of view, the tool is proved to be a simple GIS tool for not-too-complicated projects such as housing project visualization. It can response to the project’s need, is easy to develop, but yet flexible enough for further adaptation.

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