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Brief Biography:

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My current responsibility is the research about spatial information technology which is focused on computer system and the knowledge Management.

I received my Bachelor's Degree in Mathematics at Mahidol University. I completed my Master Degree in Computer Science and received my Doctoral Degree in Computer Science at Chulalongkorn University, Thailand.

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His key work as director of HAI is to develop integrated operation systems for water resource and agricultural management in order to support the decision-making processes of other related agencies in setting up plans to prevent or relieve the impacts of natural disasters.

He finished his doctoral degree at the Informatics Institute, Innsbruck University, Austria. Using his knowledge of mathematics and informatics, as well as his experience in water issues, he has developed various different projects in collaboration with private and government agencies to enhance water resource management in Thailand.

Time Dimension on the Internet GIS Application

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Abstract

Today, there are many existing GIS applications which are developed to represent the real world locations in the map-forms. With the applications operating on Internet system, the GIS data are easily accessed and distributed. The time component is an additional dimension which is integrated to display the present and historical information. It has developed for serving point, line and polygon vector GIS data. The case of flood in Thailand between 2005 and 2008 is a sample operation proposed in this paper. This implementation is an example of visualization application and an assistance tool for analyzing and planning the water management in our country.

1. Introduction

In the present, there are many existing GIS applications which are developed for the environment plans. These applications are the assistance tools for supporting the decision-making. Moreover, these existing applications have the time analysis operation. TimeMap (Ian Johnson) is a good model of time dataset visualization software.

The time control operation is the additional dimension which has been integrated in the GIS application available on Internet system. The purpose of the implementation in this paper is to develop the time dimension and to increase the efficiency for the Internet GIS system of Hydro and Agro Informatics Institute's technology. The time control operation provides the visualization of the historical spatial information to assist the water management. The time-stamped information are useful for the water plans in our country. It will also be used to analysis and warn the environment disaster such as flood, drought, and landslide in the future.

The remaining of this paper is organized as follows: Section 2 presents the background technologies of the time control implementation. Section 3 proposes the time control operation developed on the Internet GIS applications. In Section 4, An example of the time control prototype are shown. Finally, Section 5 is the conclusion and further works.

2. Background

Time control operation is one component on Internet GIS system developed by Hydro and Agro Informatics Institute or HAI in Thailand. This time component is integrated in the Internet GIS applications for displaying historical data in the map forms. There are two concerning technologies as follows:

2.1. Internet GIS application

The Internet GIS application can be created from the Internet GIS system which is one of Hydro and Agro Informatics Institute's technologies. As shown in Figure 1, the Internet GIS or Web-based GIS application architecture is able to classify into three main modules as follows: Database, Pre-process, and Operation&Display. Database module includes general database management system, spatial database management system, data collections, and import and query data processing. The application has been specifically developed not only to handles both spatial and non-spatial data, but also to handles both vector and raster data formats. In Pre-process module, the vector and raster data

controlled with the Control Table operation. This operation is the database operation that is applied to determine and to handle the menu list of spatial data, for example, the enabling and disabling list, the adding list, and so on.

The Internet GIS user interface as shown in Figure 2 is one application of HAI Internet GIS system. It runs on a Linux operating system server and is written with PHP, HTML, Javascript, and XML programming languages. In addition, we use the open source database and spatial database such as PostgreSQL and PostGIS, respectively, to collect the spatial and non-spatial data. These data in the map form can be accessed from anywhere clients.

2.2. Internet GIS spatial operations

The structure that is concerned with the Internet GIS spatial operators is briefly mentioned in this section. As shown in Figure 3, the spatial operations are the GIS processing functions to perform spatial analysis. There are two modules of spatial operations addressed in this application. First, the inputs files are processed by this operation before these data are imported in the spatial database. They are operated in suitable data by using the spatial operators such as `Geom_union` (geometry union), `Geom_intersection` (geometry intersection), `Geom_identity` (geometry identity), and so on for meeting the objective of applications before they are converted to SVG formats. For example, some classified spatial data have the large size, so these data are generalized by simplify function (in PostGIS) to reduce time-consuming data loading. Another spatial operation module, the spatial data can be manipulated on-the-fly by the spatial operators. The map control functions such as area measurement, zoom-in/zoom-out, panning the map, and so on apply the spatial operators for its operation.

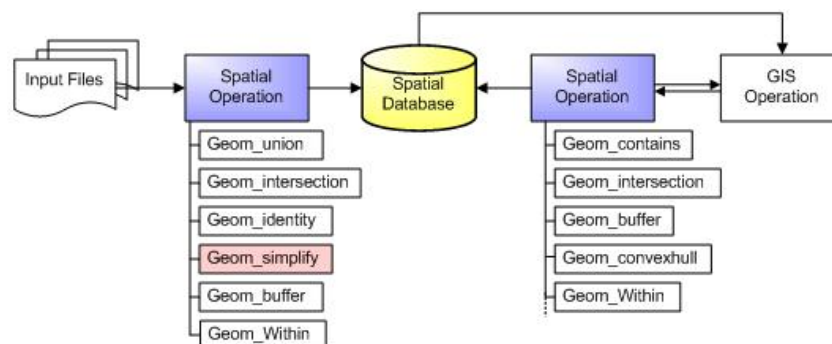


Figure 3. Spatial operations in Internet GIS system

3. Time control operation

This section is a description of the time control operation which is one dimension represented on the GIS visualization application. The first prototype of this implementation is to display the flood behavior in Thailand for helping the decision-making. The time control operation is integrated in the Internet GIS application for displaying the historical spatial data. A diagram of the preparation spatial data processing in this time control module is illustrated in Figure 4. The spatial data are imported to the spatial database such as PostGIS after that they are arranged by the spatial operations. The `Geom_simplify` spatial operation is used to reduce the size of source files that is a cause of the time-consuming data loading. The vector data are used as the output for the time control component. The system developed by HAI provides and generates the vector map in SVG format. These output files are placed on the server to demonstrate the spatial data on the clients browser in the map-forms. The time operation is developed for serving point, line and polygon GIS spatial data.

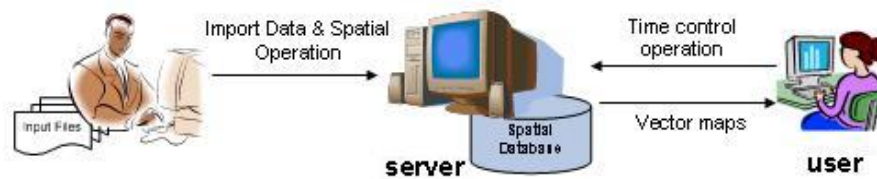


Figure 4. Time control operation diagram

The time control operation has been developed to handle time and provide the vector map animations. It runs on a Linux operating system server and is written with PHP, HTML, Javascript, AJAX, and XML programming languages. The open source database and spatial database such as PostgreSQL and PostGIS respectively are used to collect and manage the geographical and non-geographical data. The combination of HTML and PHP is applied for the user interface of the application. The interface programming scripts are written with Javascript and AJAX technology. The XML makeup language is used to display the spatial data in the vector map (SVG format).

4. Time control prototype

The prototype of the time control operation component has been developed on the Internet GIS application to display the time-stamped records of flooding in Thailand. The separate time control window box is called by pressing a time control button on a toolbar above the map bounding area as shown in Figure 5.

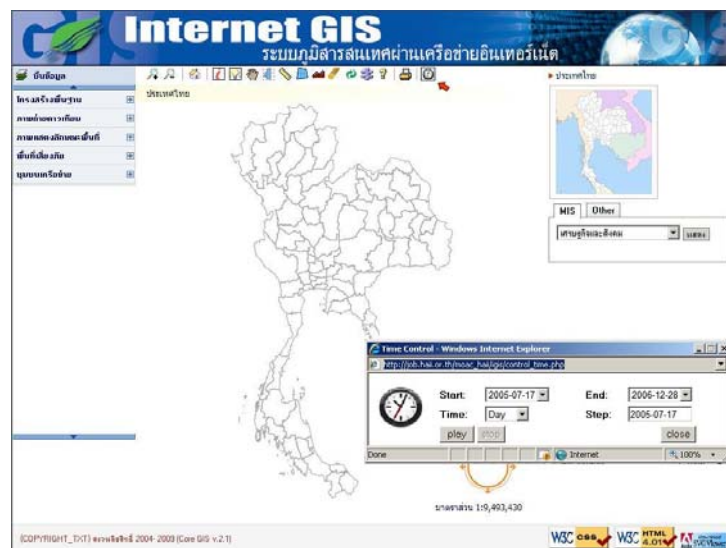


Figure 5. Time control window on Internet GIS application

The flood data from 2005-2008 is used for this implementation. In Figure 6, users can overlay the historical spatial information with the selective time information. The vector layers of flooding data during the query date range are continuously displayed on the map.

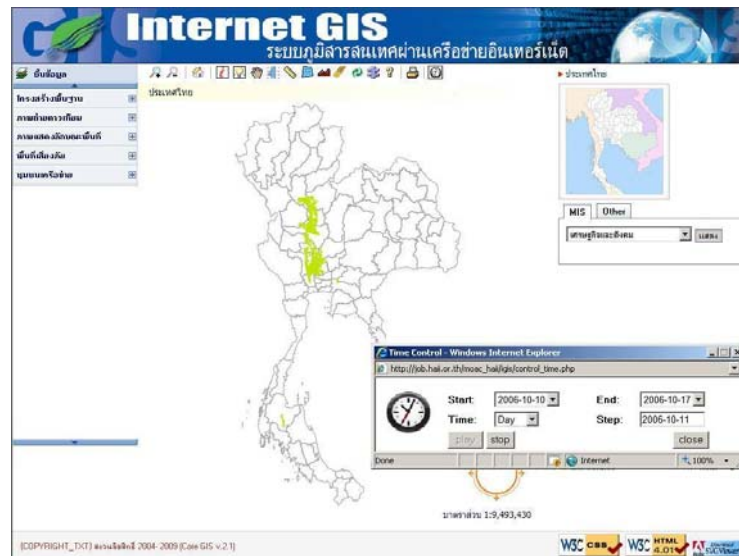


Figure 6. An example of time control operation

5. Conclusion and further work

An advantage of this implementation is the publishing operation. The time-stamped spatial data is available via Internet system. The vector data layers in the selective time intervals are dynamically displayed to understand the flooding pattern of Thailand.

The time control operation that can handle time analysis by providing time graphs will be developed. In addition, the time animation bar for displaying the time step will also be developed in the near future.

Acknowledgements

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