

SPATIOTEMPORAL DATABASE DESIGN OF SERIAL INSURGENT EVENTS IN THE SOUTHERNMOST THAILAND

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ABSTRACT: Due to the political, cultural, and religious conflicts, serial insurgent events in the southernmost Thailand, covering 3 provinces i.e. Pattani, Yala, and Narathiwat, have been active since 2004 to recent. They cause impacts to overall societies in Thailand. The events have become more and more severe and there is no sign to stop. Few databases of these events are being recorded as relational database but no specifically on temporal data. The purpose of this study is using UML (Unified Modeling Language) to design the object-orientated GIS database system involving spatial, attribute, and temporal data. Conceptually, the system user requirements are obtained from questionnaires. Logically, the temporal data are designed based on temporal geometric primitives (instant and period), temporal reference system (calendar and clock), and operation on temporal relative position of ISO19108:20002. Because of lacking of systematic positioning data, the most detail spatial data are recorded by points of landmarks such as villages, school, mosques, monasteries, etc. Attribute data involve in active firebrands, action approaches, weapon, and vehicle used, relevant events, etc. The system will be further developed using object-orientated programming and the Google API (Application Programming Interface). The web-based application of the system designed will include functions, for instance, create, add, edit, delete, import, export, interactive table fusion, and display. Few years of data will be input for the system and application tests. The system developed could be useful and helpful specifically for experts in criminology of government agencies.

1. INTRODUCTION

One of the most popular daily news in Thailand now is the insurgent events in the southernmost Thailand covering 3 provinces i.e. Pattani, Yala, and Narathiwat. They have been constantly occurred almost every day for years since 2004 to recent. It is analyzed that they are active because of the political, cultural, and religious conflicts. This causes impacts to overall societies in Thailand. The events have become more and more severe and there is no sign to stop. So far, there is no data collection which is systematic, covering all types of data, and analyzed or queried and reported effectively. Temporal data have been recorded but not in the form that can be queried to response the purposes extensively. The data collected are not structured in form that allows query specifically. Also, no efficient tool and interface that can analyze and query data are developed.

The data of serial insurgent events available have been collected in form of the relational database, which is used widely and has limitations when applied to such complicate data like these (Adnan, 2005). The transaction cannot be processed large amounts of data quickly and effectively as object-oriented database.

The object-oriented database system has been evolved with the technology using object-oriented programming (OOP) to solve difficulty experienced using relational database (Abraham and Roddick, 1999; Chen and Jiang, 1998). The object-oriented database system will be suitable for storing spatial, non-spatial, and temporal data, which contains great volume and continuity, with less complicated management.

To provide information in the form and the content that will be used appropriately, data classification, structuring and the provision and query of information of time-related attribute data should be managed in accordance with ISO 19108 (International Organization of Standardization, 2002). The UML (Unified Modeling Language) was used to design a schema for database construction. The web-based tool/interface developed will serve user requirement obtained from questionnaires in many aspects such as update, edit, search, query, etc.

The objective of the study is to design 3 components (spatial, non-spatial/attribute, and temporal) of GIS database related to the serial insurgent events in southernmost Thailand using UML for OOP.

2. CONCEPTUAL FRAMEWORK OF THE STUDY

The study framework started with collection data of insurgent events and user requirement survey. This was used as a guideline for the database and tool design. Basically, the design included conceptual, logical, and physical stages (Arctur and Zeiler, 2004; Wahid, 2009). The spatiotemporal database and tool were tried to develop according to the design schema with examples of data in order that the specification of the database and the requirement can be checked. Additionally, the implementation of database and tool were tested and the results were checked how they meet the requirement.

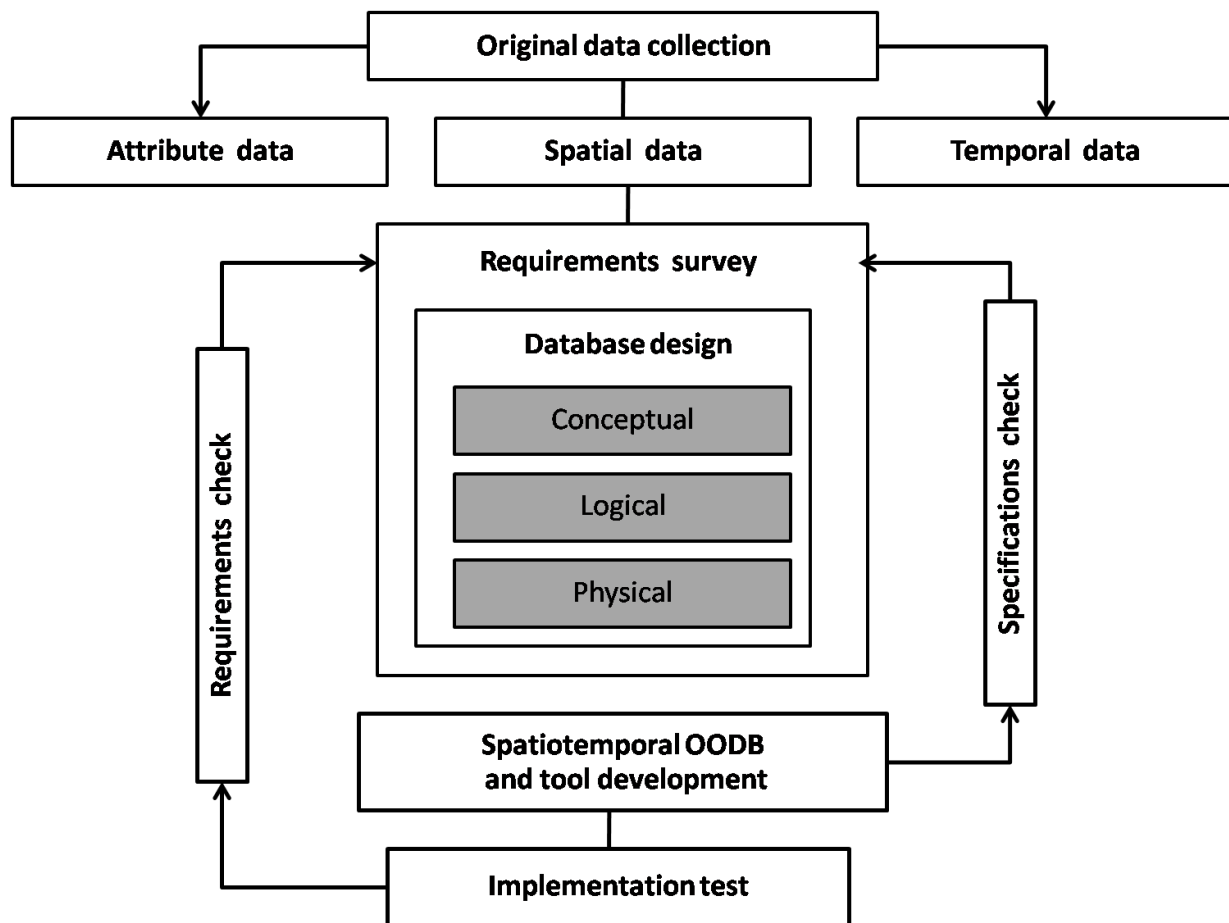


Figure 1 Conceptual framework of the study

3. DATA COLLECTION

The data of insurgent events from 3 provinces in the southernmost Thailand i.e. Pattani, Narathiwat, Yalasinca of 2004-2005 were mainly gathered from the database of southern border area news via the web site <http://wbns.oas.psu.ac.th> (Figure 2). The spatial data can be accurate to the village level which is represented by points of the village centers updated to 2007. Non-spatial data are in form of text base without full structure. Therefore, they cannot be effectively used for query and analysis as same as spatiotemporal database in fashionable format (Peuquet and Duan, 1995). Temporal data are not collected in form that their relationship can be queried as the user requirement. They are not stated as instant and period as described in ISO 19108:2002. This leads to the idea of proper data structuring designed using UML.

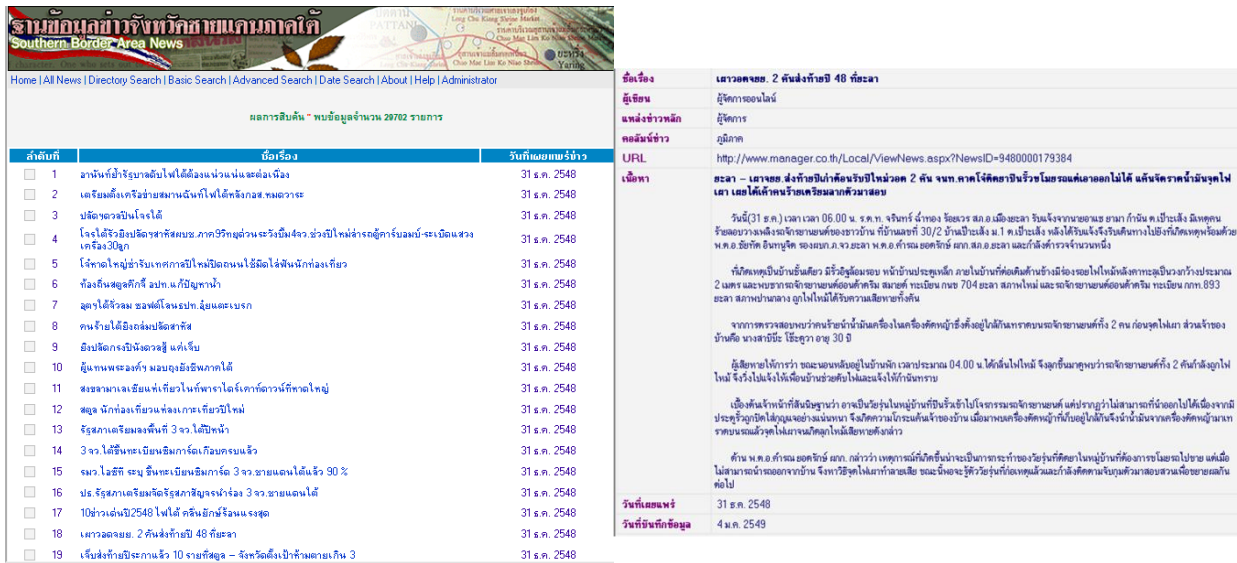


Figure 2 Examples of the original data from the database of southern border area news.

4. DATABASE DESIGN

4.1 Conceptual Design

A user requirement survey by questionnaire helps to gather opinions on user management, the data elements needed, and application styles. The survey revealed that the users should be separated to be levels of administrator and operator according to the permission assigned. The data content should cover active firebrands, action approaches, weapon, vehicle, relevant events, etc. The detail can be referred to the database schema designed. The database developed should be able to apply through the web. They should be able to update, edit, delete, import, export, report, analytical query, and display in attribute records (Langran, 1993). Also, the query result can be displayed in a map/satellite image or both. These requirements were set as the target for logical and physical designs.

4.2 Logical Design

The content of text-based original data was considered so that the data could be separated into groups of fields of temporary table e.g. date, time, weapon, location, result, etc. This helps to further design the database schema using UML to cover the whole data thoroughly.

The database schema was designed to be object-orientated system. A set of objects of the schema represented as classes are shown as examples in Figure 3. There are 6 classes in the figure, namely ST_Event, TM_Instant, TM_Period, TM_CalendarEra, TM_Calendar, and TM_Clock. Their relationship can be described as follows:

- ST_Event is a main class. It relates to TM_Calendar and TM_Clock as ‘association’ with one to one multiplicity.
- TM_Instant and TM_Period are related to ST_Event as ‘generalization’ or ‘a kind of’.
- TM_CalendarEra is related to TM_Calendar as ‘aggregation’ or ‘a part of’.
- TM_Clock is related to TM_Calendar as ‘association’ with no limit.

The database schema was later generated to be data dictionary in the Database Management System (DBMS) where the database was developed. The data dictionary contains 24 tables with certain structure such as a number of fields, field type, field width, and its explanation. The generated result, as a part of the database, is shown in Figure 4.

Spatial data of events were designed to be points. However, no GPS data is available in the records of the original data. Therefore, they were recorded by attributes of landmarks such as villages, school, mosques, monasteries, etc. and were generated as point data displayed in maps or satellite image. The GIS point data were adopted from the data layer prepared by the Royal Thai Survey Department.

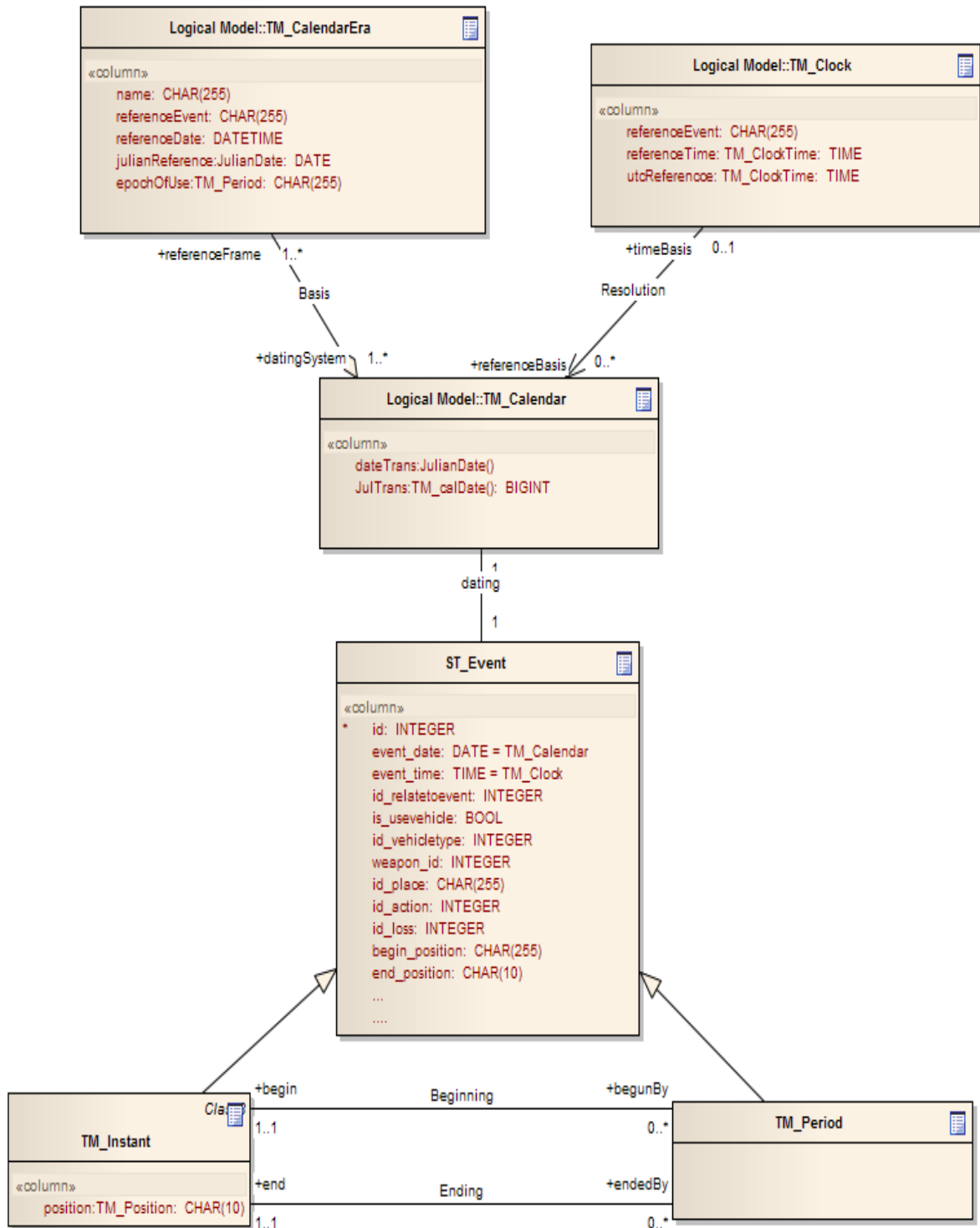


Figure 3 A part of database schema of the serial insurgent events in the southernmost Thailand.

4.3 Physical Design

The data system was designed to be the web-based application using Ajax and Google technologies. Ajax script was used to communicate to the Application Programming Interface (API) of the Google Map. The database schema was designed using the UML. The freeware MySQL was used as the DBMS. PHP language was used to code interfaces to contact to MySQL via Apache which implements as the web server. The interfaces run on the web browser.

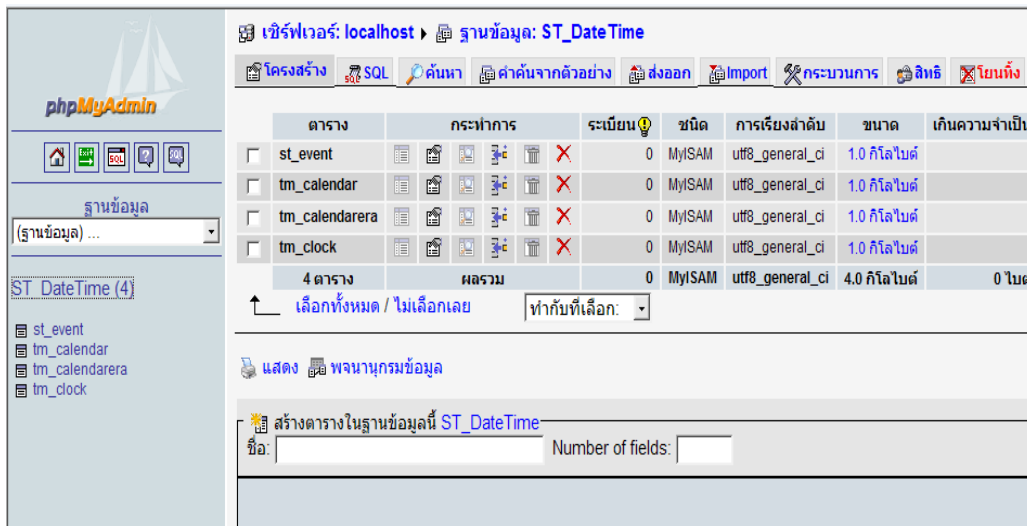


Figure 4 Tables as a part of the database in the DBMS generated from the UML schema.

5. FURTHER DEVELOPMENT

Parts of the database were constructed following the design. The data of 2004 and 2005 were input as a try. All database specifications were checked to meet the user requirements obtained from the survey. The functions such as add, edit, delete, update, search or query were able to operate through the interface as an example shown in Figure 5. Database implementation was partly tested. It works as expected in the design.

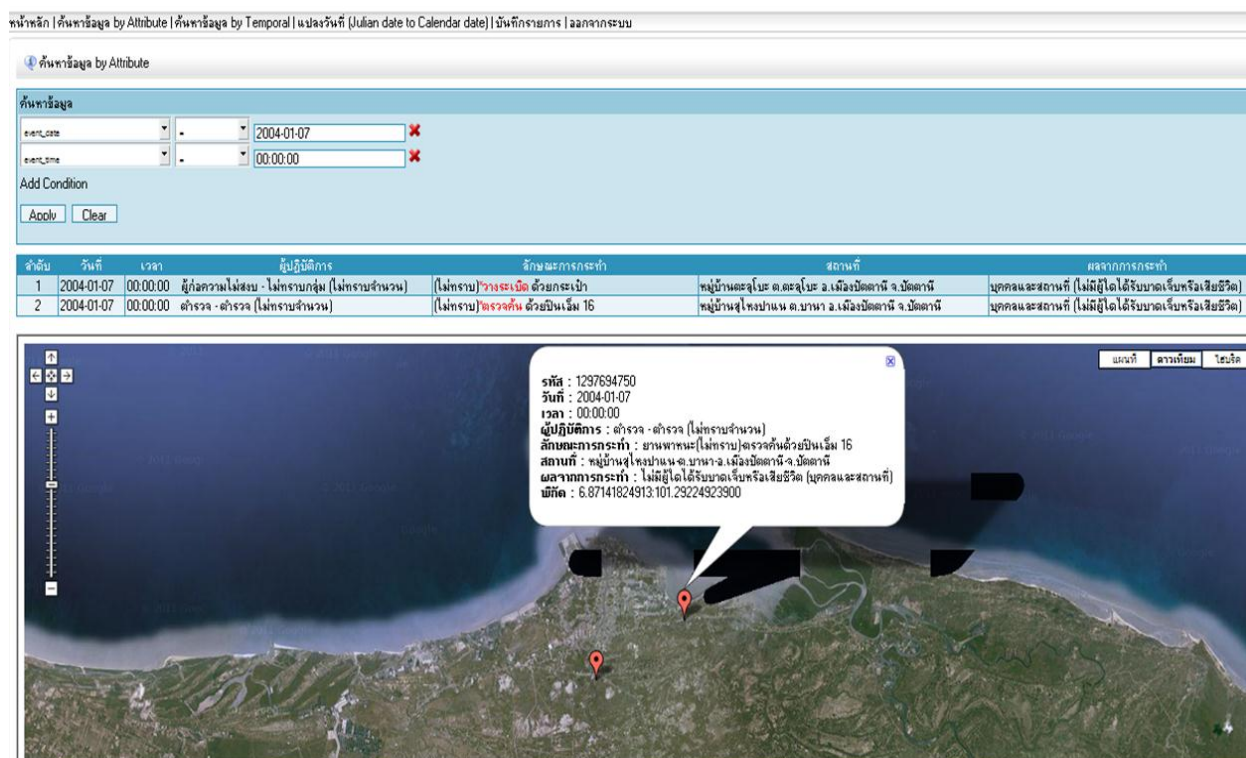


Figure 5 An example of query interface.

The database developed should be tested by the target users who know how to apply all data contents for specific purpose. The advantage and disadvantage of the data system should be fed back. Then, more applications on conditional query to cover all data elements should be further improved, adjusted, and added so that the system can response more to the user requirement. The specific application interface might be able to develop more efficiently if the government officers who know criminology and the system developer can incorporate interactively.

6. CONCLUSION

The web-based database system design of serial insurgent events in the southernmost Thailand was carried out to contain 3 components of GIS data and the basic functions based on the survey of the user requirements. At the moment, the technologies employed in the study were more or less close to the fashionable cut of edge. The details were more concentrated on non-spatial and temporal data. The original data able to collect were limited on spatial data. The system was developed with low budget and freeware was basically employed in the study.

The system designed and tried to develop is proved to be the initial mile stone to benefit the target users. The data base specifications and implementation were checked and passed with satisfactory. Various styles of queries on non-spatial and temporal data can be performed successfully. The system will be more useful and powerful for crime investigation if addition on spatial details of the original data and serious incorporation of the target users and the developer are possible.

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