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A new GIS - based Integrated Approach to Preserve Kelantan Vernacular Architecture

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Abstract

This paper seeks the knowledge regarding management of valuable vernacular houses towards architectural preservation in Kelantan with an integrated multidisciplinary approach. The study explores a new innovative trend in building preservation by using a system frequently applied in geographically oriented network computer technology. Data were collected through Case Study and field survey using qualitative approach, with the main focus on identifying typology, distribution and cataloguing. The collected data were analysed using Geographic Information System (GIS); and thus, traditional houses in Kelantan was identified, characterized and catalogued. This allows the integration of several documents in a common geo-database, and establishes criteria for a dynamic and rational selection of houses. The research highlights the opportunities for architectural preservation sustainability and GIS to work in a partnership of profound strength and mutual achievement. Hence, the main finding in cataloguing of vernacular houses, preserving a valuable source of information and compiled on thematic charts. By revealing heritage values and recovering aesthetic elements, contribution to job and wealth creation is plausible.

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Key Words: Geographic Information System (GIS), Cataloguing, Vernacular Architecture, Preservation, Sustainability

Introduction

The Malaysian economy is in transition with the pressures of the global economy and the threat of contract trapped in the middle-income trap. In 2010, the government announced the New Economic Model (NEM), which is needed to transform Malaysia into a high income nation by 2020, finding a new economic model as well as in response to slow growth which Malaysia has experienced since the 1997-1998 Asian financial crises. This is exacerbated by the growing competition for export and foreign investment from neighboring countries.

Based on the revenue in 2010, the National Transformation Programme (NTP) has announced to implement the NEM. NTP comprised of two components; the Economic Transformation Programme (ETP) and Government Transformation Programme (GTP). Although different, but both programs work in tandem to achieve the aspirations of the country for the 2020 implementation. Monitoring of the ETP is projected to propel the country towards a high-income status by 2020, a move the GNI per capita to $ 15,000. This will be achieved by attracting US $ 444 billion in investment, which will create 3.3 million

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jobs. The main thrust of this ETP, therefore, is to return to the private sector to the real role as the main engine of economic growth.

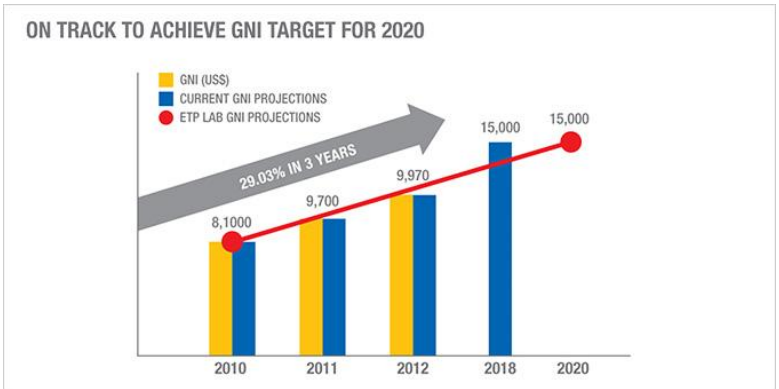


Figure 1 : GNI Target for 2020. Source : Performance Management & Delivery Unit (PEMANDU) (2013)

According to Economic Transformation Programme (2010), sector consists of their potential to contribute to GNI and create a multiplier effect across the economy in Malaysia is a source of foreign exchange earnings, contributing to significant economic growth, attract investment and provide employment opportunities. In the context of the "Tourism", architectural Malaysia is one of the main sources of tourist attractions to be seen from a deeper perspective. Therefore, cataloguing and promoting rural architecture will contribute to job creation by stimulating new economic activity such as cultural tourism; preserve valuable resources of information on rural culture, recovering local construction techniques, promote a sense of community, and make the villages and rural areas more attractive to visitors (M. Cano et al., 2013). Knowledge, skill and information are the main steps for the preservation and the valorization of the whole architectural heritage (Franca Restuccia, 2013). Referring to the economic issues and the preservation of buildings in Malaysia, the path to the Historic Preservation Act of 1966 by Congress should be viewed as a whole in protecting the cultural heritage of the country that is almost extinct and partly in the economic and cultural value of historic preservation has become widely known and has been moved into maintenance issues in the forefront of public policy and popular interest (AIA, 2010). Historic preservation is a universal term that refers to several types of treatment functions and jurisdiction of the historic building conservation agencies that may include rehabilitation, restoration, preservation, and reconstruction. Although some may operate in overlapping, explanations received are as follows:

Preservation: concerning the measures necessary to sustain the integrity, existing form and materials of a historic property. Preservation work generally concentrations on the ongoing maintenance and healing of historic fabric rather than extensive auxiliary or new construction.

Rehabilitation: adapting a property for ongoing or new companionable use through repair, alteration, and additions, while preserving those measures or features that transfer its historical, cultural, or architectural values.

Restoration: accurately portraying the materials, features, form and character of a property as it appeared at a particular period of time. Restoration recollects as much of the historic period fabric as conceivable. Inconsistent features may need to be removed and missing features faithfully reconstructed in accordance with the restoration period.

Reconstruction: representing by means of new construction the materials, form, features, and character of a historic property that no longer exists, as it seemed at a particular period of time, in its historic location.

Preservation Benefits

The greatest benefit of historic preservation is the protection and explanation of our traditional heritage. Houses are a true record of the period or culture that created them. They are a prime source of historical information. The historic and social value of preserving older neighborhoods, restoring a landmark county courthouse, or adaptive use of railroad stations or other underutilized buildings across the country far exceeds the direct economic benefits. Preservation makes a significant contribution to the beauty and enjoyment of our cities, towns, and rural landscapes and to the quality of life in these special places (AIA. 2010).

Both public and private owners have realized the economic benefits of preservation. Cost savings, materials, and energy in the adjustment or maintenance of existing buildings is essential. Reuse of the existing structure and not the creation, delivery, and construction of a building with new materials can save energy and natural resources. Owners of historic buildings recognized landmarks or located in the historic district is eligible for other financial benefits. Federal tax laws and regulations of the Internal Revenue Service provide tax credits for the rehabilitation of commercial buildings listed on the National Register of Historic Places.

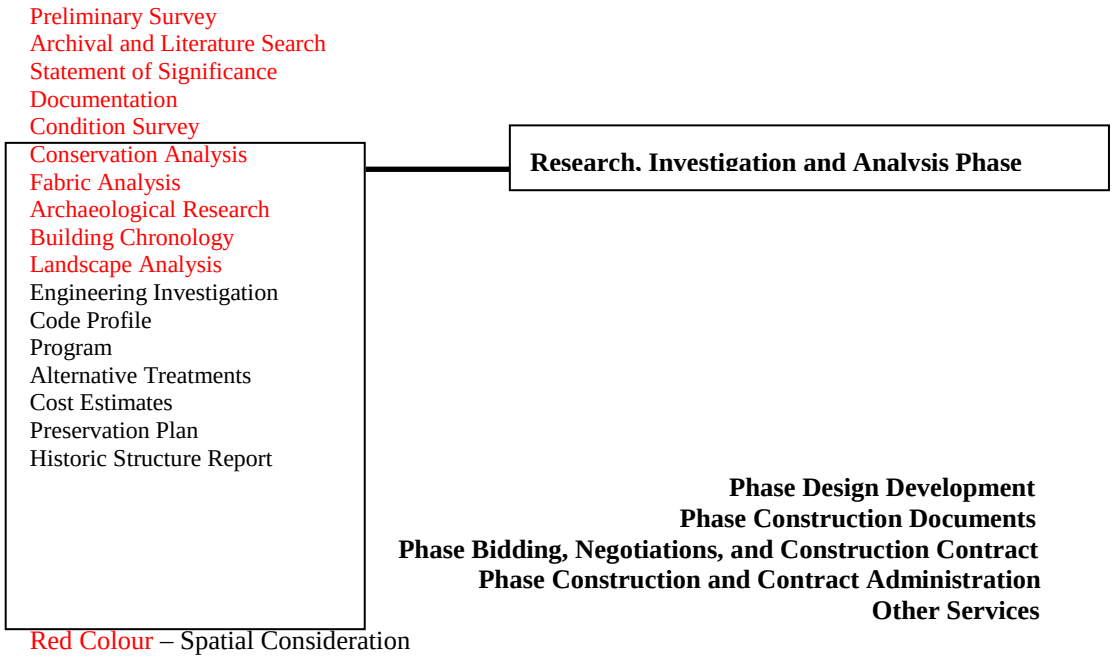


Figure 2 : Preservation Services

Source : Adapted from American Institute of Architects (AIA) (2010)

Figure 2 shows the Preservation Services that consists Research, Investigation and Analysis Phase, Design Development Phase, Construction Documents Phase, Bidding, Negotiations, and Construction Contract Phase, Construction and Contract Administration Phase and Other Services (AIA, 2010). GIS will recover the Research, Investigation and Analysis Phase under Preservation Services in Figure 1 which is out of 17, GIS can covers 10

spatial data that consists :

Preliminary survey: describes the property in general terms and evaluates its level of integrity, physical condition, and probable historical significance. Recommends historic preservation work plan, professional services that will be needed, and preliminary cost estimates for continuing work.

Archival and literature search: locates, identifies, and assembles original drawings, historic photographs, and written accounts or descriptions that will aid in tracing the development of the structure through different periods.

Statement of significance: following a period of historical research, it will be possible to prepare a more detailed and accurate account of the property's significance and define the elements of its integrity. Information in this statement will be essential to determining the best work plan and treatment for the structure. The statement will also be of value in relation to surveys, lists, planning actions, grants, and appropriations. The statement may need to be amplified as site investigations and analysis progress.

Documentation: prepares measured drawings, collects field notes, and takes photographs that will provide a record of the property as found.

Condition survey: utilizes the record drawings and photographs; describes and maps the condition of the structure; and identifies the types, locations, and probable causes of problems.

Conservation analysis: investigates and monitors the structure in relation to its behavior and composition. Recommends procedures for stabilizing the building, controlling the interior environment, minimizing further deterioration, and repairing damaged parts.

Fabric analysis: analyzes the materials, workmanship, and equipment of the structure in relation to their physical nature, sources, and dates of construction.

Archaeological research: investigates below-ground project area particularly on historically important sites to recover, protect, and evaluate artifacts and earlier periods of occupation and use. This research often provides important information for restoration or reconstruction.

Building chronology: traces the development of the structure through its construction periods, ownership, and uses. Conclusions are based on information gathered in the fabric analysis and the archival and literature search. This analysis usually takes the form of text and a series of chronological plan overlays.

Landscape analysis: surveys existing conditions and historic significance of landscape design, features, and other site considerations.

The application of GIS in real estate were established in the USA and started to develop in the UK since the early 1990s. There is evidence residential has shown to be the sector with most of the identified research, particularly since the late 1990s (Suriatini I., 2005). Nevertheless, literature on GIS applications for architectural preservation is not well developed. GIS is a relevant technology for architectural preservation since all houses information is inherently spatial because houses are fixed in geographic space. (Belsky et al., 1998). In architectural preservation, GIS is very unique compared to another software

because GIS has the advantages of efficient Data Integration/Management (data set) and Spatial Analysis. Hence, spatial data that refer to the map and attributes describing the map is one of the features of preservation purposes and services. Three broad perspectives on the GIS map focusing on the importance of processing, database and spatial analysis. Evolution of GIS is described as three main stages of resource inventory, analysis and management activities (Crain & MacDonald, 1984). Figure 3 highlight the linkages between GIS and Architectural Preservation as like a bridge that should linked together in order to enrich the capabilities of GIS in architectural preservation.

Figure 3 : Linkages between GIS and Preservation Purposes

UNIQUENESS OF THE QUANTUM GIS IN ARCHITECTURAL PRESERVATION

Based on Managing Director of GIS Innovation Sdn Bhd, Lyes Mokraoui, the beauty of the QGIS are free and open source. It works very fast and powerful software developed by Python software. It's fast learning curves and through cross platform software like window, Mac, Linux and Android. It support a huge variety of vector data and no limitation is use. Proprietary and or open source format. It's available for everyone with huge available community through forums and frequence updates.

The Convergence Of History And Geography In Preservation Gis

Old saw that history is the study of when, where geography studies, has some thruth to it (Anne K. Kelly, 2002). Geography is the study of different space, historical studies in which temporal differentiation historical GIS provides tools to combine them to study patterns of change in space and time (Winnie T. & Jan S., 2003). GIS enrich both qualitative and quantitative approaches to history. For those who see the relationship dimension of visual maps, GIS gives us the opportunity to measure the distance, direction and characteristics of the statistical characteristics (Myron P. Gutmann, 2002). The intent of each map is to convey knowledge of geography. Map using various graphic techniques using color, size, annotations and symbols to display information about what is in every place in the map. The purpose of the map is to show useful information to the reader the task of this map. Map designed to support spatial analysis in the minds of consumers the map (Benjamin C. Ray, 2002).

Geographic information systems today produce maps to support the goals of the map reader, but with the advantages of computer technology. With a strong GIS display and analysis functions, you can think of a geographic information system such as a telescope to geography (Michael Z., 2010). The ability of GIS to integrate, analyze and visually represent spatial information referred to is inspired historians to combine resources in new ways, to make the geographical context and a clear division of their analysis, re-examine the evidence that common, and to challenge the long-standing interpretation history (David W. Lowe, 2002). GIS history prove increasingly valuable as a method of research, a framework for the digital archive, and a tool that brings geographic sensitivity to our view of history (Anne K. Kelly, 2002). It can reveal spatial patterns of people, objects, although transient events, whether items were recorded archaeological artifacts, houses, a parish, state or dust storms.

Outside location, GIS allows researchers to record and take a lot of the characteristics of the identified items which can investigate the location and characteristics at the same time to tell stories about the past enriched (Myron P. Gutmann, 2002). Also connects digital GIS location and their properties so they can be displayed on the map and analyzed, either by their geographical features, such as location, distance, distance, density and dispersal, or by their properties, such as social, economic and physical characteristics (Anne K. Kelly, 2002). Connected through a hot line for certain features in the GIS layers, maps open certain configurations (David R. & W. Meredith, 2002). That is, the selected control points on a scan of the original map should be in line with their actual geographical location, either by giving the geographical coordinates for each point, or by connecting each point to its equivalent, the user can bring historical data on each site (Aaron C . D. Sheehan, 2002). By using GIS to integrate geographic information, the social, economic and political about these places help researchers see that the typology Kelantan focused and deviate at the same time. The perspective of our society has adopted to help researchers capture the influence of architecture and peaceful aspect may have emerged as a regional conflict (Aaron C. D. Sheehan, 2002). Local inquiry is built on the basis of various evidence may help researchers understand the nature and consequences of shared experience and different from Kelantan and neighboring areas such as Thailand, Terengganu, Perak and Kedah.

Methods And Data Collection

The early stage of research involves a series of literature on two topics, which include the traditional houses of Kelantan in terms of typology, history, elements, status and other buildings, which are associated with traditional houses of Kelantan, Malaysia. Meanwhile, the second stage of the study involved the analysis of GIS, consists of a site visit to each of which focuses on traditional houses for the purpose of inventory and abroad as comparative information. Therefore, visits were made to obtain important data and reference records new traditional houses, including 43 sets of measured drawings by surveying existing traditional house through content analysis by using RKB_001 coding for example R symbolize for *Rumah*, K stand for Kota and B for Bharu which is reflect the area of the research and the number 001 for houses selected number. Meanwhile, other visits to Algerian expertise on GIS, Lyes Mokraoui's office as a Managing Director of GIS Innovation Sdn Bhd, at Kuala Lumpur were conducted. Methods and Data Collection techniques are based on the qualitative method approach focusing on case study through the content analysis and field survey.

Historical And Architectural Overview

Area of Study

As shown in Figure 4, the state of Kelantan is situated at the North Eastern of Peninsular Malaysia, bordering Thailand and the South China Sea. The capital of Kelantan is Kota Bharu. Kelantan is one of the Malay belts states of Malaysia and the surrounding regions and Siam influence to some extend the architecture. With a population of about 1.8

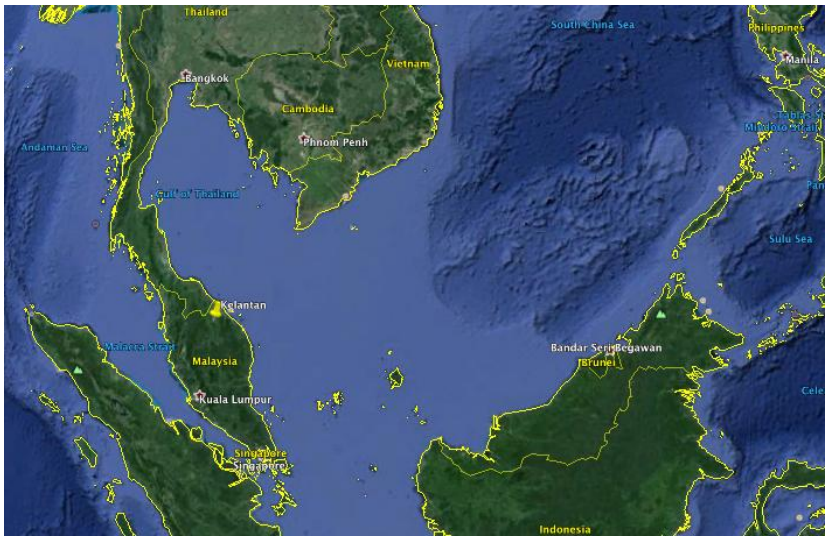


Figure 4 : Location of the Kelantan, Malaysia

million, ninety five percent of the people are Malays. Since 1971, other countries including China, India and Thailand and Cambodia small percentage of Muslims make their home here. Kelantan people are free and have managed to keep the old customs and traditions and the ability to maintain and preserve the rich cultural heritage of the Malays and is often referred to as "Cradles of Malay Culture".

Discussion & Findings

Geographical, Descriptive And Interactive Data Banks

There has been the creation of three connected data banks: "Geographical data bank", "informative framework/descriptive data bank" and "Interactive data bank. The "Geographical data bank", which involves the study area and the buildings involved in all districts in Kelantan has been created by supplying information about the architectural preservation. In order to insert data into QGIS from GPS in decimal degree, from (figure 5a) the data should import from CSV with preparing in table containing rows that include at least fields for: Platform_ ID, Latitude, and Longitude.

a)

	A	B	C	D	E
1	PLATFORM_1D	LAT_DEGREE	LONG_DEGREE		
2	RKB_001	6.134	102.2361389		
3	RKB_003	6.1349444	102.2358056		
4	RKB_004	6.1372222	102.2371944		
5	RKB_014	6.13275	102.2366667		
6	RKB_017	6.1338611	102.2361389		
7	RKB_018	6.1333889	102.2357778		
8	RKB_019	6.1573889	102.2454722		
9	RKB_023	6.1571111	102.2453333		
10	RKB_025	6.1558056	102.2767778		
11	RKB_026	6.1341944	102.2361944		
12	RKB_030	6.1338611	102.2362778		
13	RKB_031	6.1313889	102.2525		
14	RKB_032	6.1557222	102.2675833		
15	RKB_033	6.1545	102.2710556		
16	RKB_034	6.1311944	102.2521944		
17	RKB_035	6.1311944	102.2474444		
18	RKB_036	6.1338889	102.2412222		
19	RKB_037	6.1349444	102.2380278		
20	RKB_038	6.1374722	102.2373333		

b)

	A
1	PLATFORM_1D,LAT_DEGREE,LONG_DEGREE
2	RKB_001,6.134,102.2361389
3	RKB_003,6.134944444,102.2358056
4	RKB_004,6.137222222,102.2371944
5	RKB_014,6.13275,102.2366667
6	RKB_017,6.133861111,102.2361389
7	RKB_018,6.133388889,102.2357778
8	RKB_019,6.157388889,102.2454722
9	RKB_023,6.157111111,102.2453333
10	RKB_025,6.155805556,102.2767778
11	RKB_026,6.134194444,102.2361944
12	RKB_030,6.133861111,102.2362778
13	RKB_031,6.131388889,102.2525
14	RKB_032,6.155722222,102.2675833
15	RKB_033,6.1545,102.2710556
16	RKB_034,6.131194444,102.2521944

Figure 5 : a) Data Import from CSV b) LibreOffice – Calculation application Interface

The Latitude and Longitude values should be in decimal degree format (NOT degrees, minutes, seconds, format) then should save this table in Comma Separated Values format (CSV). From Manage Layers Toolbar, use the Add Delimited Text Layer tool and select the CSV file to generate a points layer. With this step, the points layer can be save to a Shapefile (or other format). Preparing Tabular Data can be developed in various spreadsheet applications with LibreOffice (figure 5b) for it's handling of specific language character set encodings. For the example, the County File of Kelantan Placename Features from USGS Country Files was downloaded. After saving and double-click the country file eg.zip to the working folder, then directly extract the contents in eg.txt, then renamed the file to eg.csv, launch LibreOffice, and the Calc spreadsheet application. From the CALC application, click on the menu item with the sequence File > Open and browse to your UNZIPPED and RENAMED file eg.csv then click OPEN.

a) b)

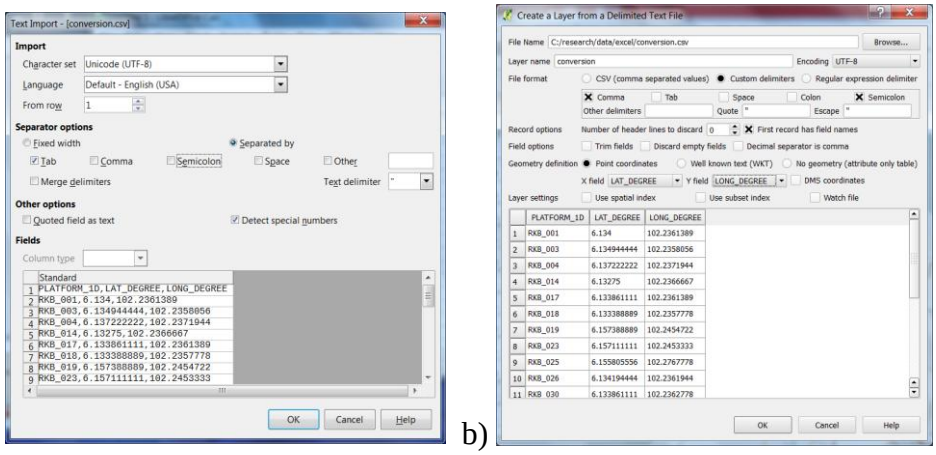


Figure 6 : a) Text Import file b) Layer from Delimited Text File

To set Character Set into import file (figure 6a), USGS Country Files must be in UTF-8, with the Language to English (USA), with only affect the Libre Office view. Thus, set the Separator (Delimite) options with case check TAB delimiter and uncheck COMMA delimiter. If the fields seem to be delimited properly in the preview, click OK at the top right. Format the Cells for your Lat Long values with enough decimal places, so that saving to CSV does not trim off your most accurate values. Currently, QGIS imports CSV as UTF-8 Encoding and if we are using any other encoding we should create TWO tables for the LAT LONG import, and one to join the other character set attributes to the resulting points layer. When the .csv is opened in LibreOffice, browse the table to check for possible import errors and SAVE it as native OpenOffice format egypt.ods. with enough decimal places, in order to CSV does not trim off the most accurate values. In QGIS, the data from excel should be add as a Delimited Text Layer (figure 6b) because the ability to import delimited text as Vector Layers is built in to the Manage Layers tools by click on the large COMMA icon to launch the Add Delimited Text Layer dialog. Then, by Import CSV File from Browse to the CSV Filename, set the Encoding (this case of UTF-8 by pick the correct Delimiter that separates each field, in the example we used Custom Delimiters and semi-colons). After set your X, Y fields and hit OK, then the Coordinate Reference System (or projection) for the imported x, y coordinates must be specify. In the case of plain decimal degrees, click on the option WGS84, also called EPSG:4326. With the correct CRS selected, hit Okay, and the points should appear as a new data layer in the QGIS Layer List and the Map View.

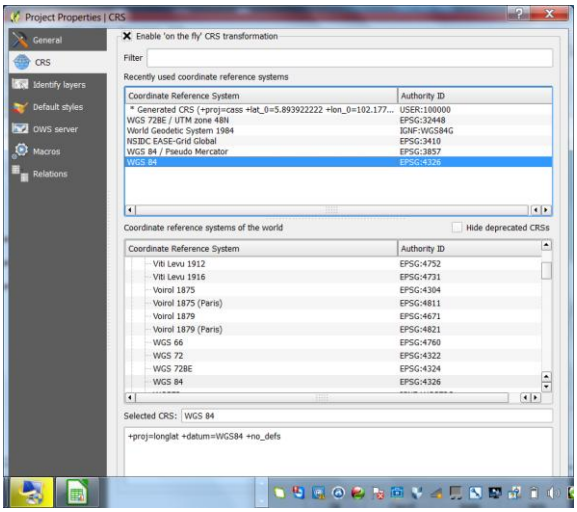
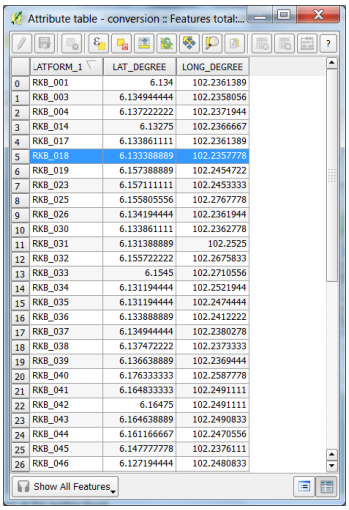
a)  b) 

Figure 7 : a) Coordinate Reference System b) List of Attribute table

In order to Check Points and Attribute Table, the imported x, y values will now must be converted to point features (in WGS84 coordinate system)(figure 7a), by Right-click on the layer to Open the Attribute Table, and make sure the tabular data was imported (Figure 7b). Check the Number of Features on the top bar of the attribute to make sure all were mapped. Since the import file was UTF-8 Encoded, use the scroll bar at the bottom of the Attribute Table to inspect the columns to the right. To save Out to SHP by right click on the layer and save as a SHAPEFILE for the later use. After exporting to SHP, right click to remove the Delimited Text Layer and use the Add Vector layer tool to add the new Shapefile which is it's be able to run spatial analysis tools and other operations on the Shapefile, which otherwise might not have been possible using the .csv file held in the memory buffer. Finally, refer to (figure 8a) use the Identify Features bar to get the Identify Results with Features Attributes(figure 8b) for that particular house that have been selected and after open the attributes, list of attribute table (figure 8c) will appeared clearly. In Descriptive data bank (figure 9), all the specific typological, measured drawing and historical data information related to the architectural elements pertaining to the restoration action can be found at this scale of representation of GIS database. "Descriptive data bank" reflects the current state of the photographic image and opinions (draft, the geometric height, the height of architecture, at different levels, details, sections, interpretation and animation), chart documentation available in the archives of history, the report also illustrated bibliography related to the building.

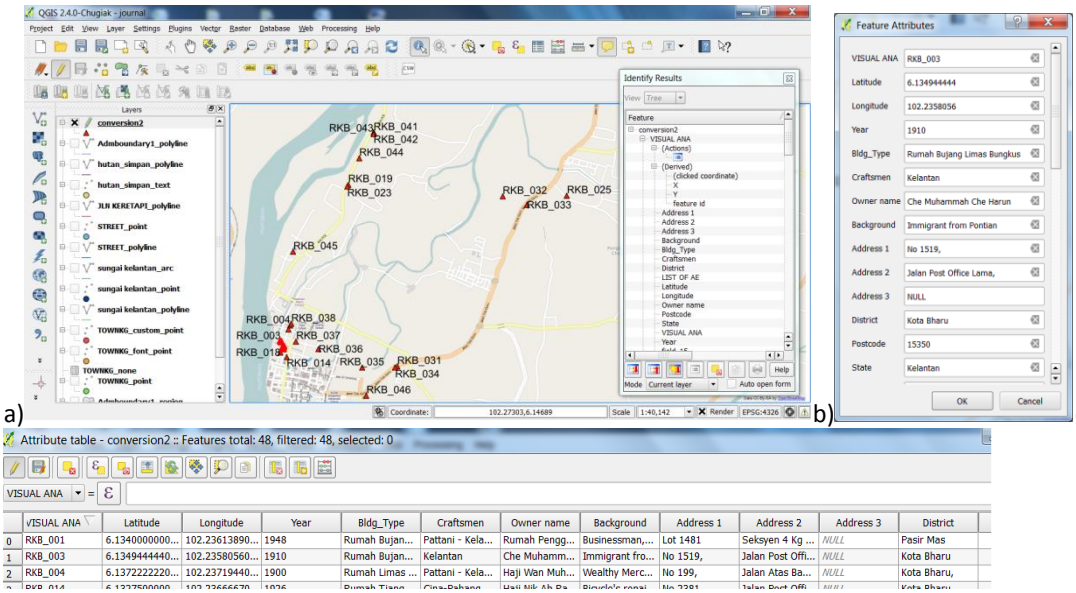


Figure 8 : Identification file and data attributes of the Traditional houses in Kelantan

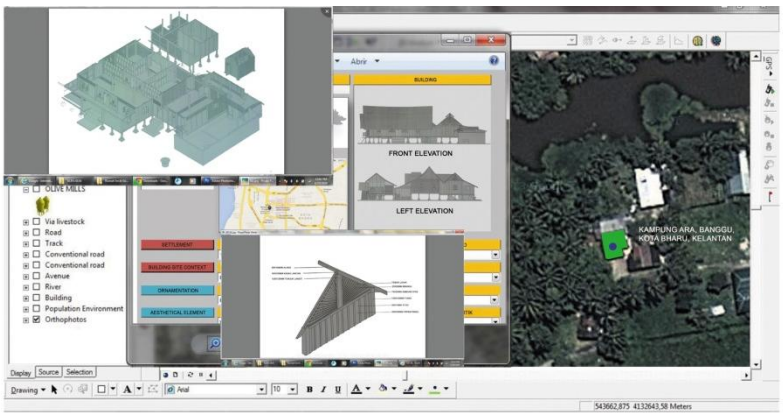


Figure 9 : Descriptive Data Bank

Most Prominent Building Typologies

A wide variety of traditional houses adorned the timber houses of Kelantan as identified from 1700 - 1970 years through visual analysis and QGIS, they were Rumah Tiang Dua Belas, Rumah Limas Bungkus/Belanda, Rumah Bujang Berserambi / Dua Beradik, Rumah Bumbung Perabung Lima/Pecah Lima Rumah Potong Perak, Rumah Siam and Rumah Bumbung Panjang Cina (figure 10). It will support by the literature about the relationship between political, economic, social factor, background of the owner's and aesthetical element were reflected the overall typology and distribution of the traditional houses. Figure 5 shows the typology of the traditional houses in Kelantan that have been analyzed during this study.

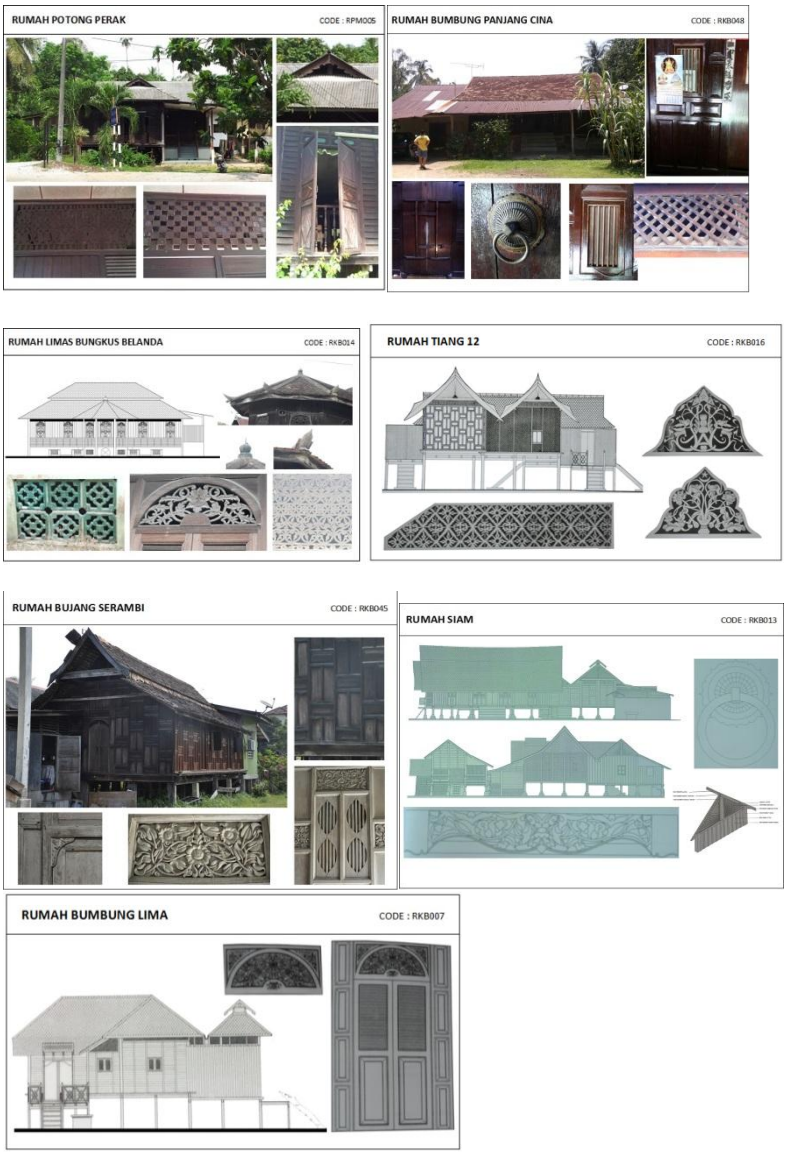


Figure 10 : Typology of the Kelantan Traditional Houses

Spatial data refers to data such as the location of the district boundary map in Kelantan, including border state, district and sub-district. As of today, there is no longer an efficient use of GIS in the preservation of buildings in Malaysia. GIS-based model enables us to find locations and possible to establish our location on the screen and devise a possible route for users wishing to visit any of the traditional buildings under study. Today's technology also has enabled us to access large quantities of data in a virtual image where the GIS database developed here is capable as an Interactive data bank to linked applications with another multimedia software like Web service. It is also important for the Local Authorities on preservation reference, academician and researcher, tourism industry, architect, town planner and creating employment opportunities. Promoting and cataloguing intensive data information in which GIS have been implemented are very valuable. Therefore, a visual description and analysis of data from interviews were very important to identify the reliability of research findings.

Conclusions And Recommendations

This study shows that the proposed method provides an effective method for inventory and characterization of buildings in a specific area (Kelantan, Malaysia) based GIS. Working tool that allows us to add new data and analysis of traditional rural buildings in a way that not only make the public aware of the region and its potential for tourism but also develop possible routes for users. As historic maps updated with spatial coordinates, large expanses of historic landscapes are available for review. As more sites are plotted accurately with GPS and brought into the GIS, our fund of knowledge and corporate information of our country will grow. Resource management and conservation will become more systematic and effective. Visitors will have more ways to understand and appreciate the past. Therefore, this method is an aid for tourism development and promotion of better, producing catalogs and rural buildings will fill the gap of knowledge as a database in advance of a comprehensive study of traditional houses in wooden architecture, particularly in finding distribution and typology in Kelantan. GIS Web services have the potential to change the way in which GIS is developed, accessed and used. They allow users to access GIS data and functionality via the web and to unite them with their own systems and applications without the need to develop or host specific GIS tools and data sets themselves. Geographic functions it is so flexible where the GIS Web services offer a new framework in which data can flow and web services architecture can be enhanced to support the delivery of GIS services for any small size companies, businesses and schools, across governments and multinational organizations, for the provision of data and functionality to the truly global audience.

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