Management of Information and Infrastructure of Indigenous Community at Royal Belum State Park Using Geographical Information System: A Conceptual Design

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Abstract. *Nowadays, an integrated location, descriptive inventory and geographical information are required for a better decision making in Indigenous community management activities. The management system can improve productivity and to save time, money and manpower . Conventional maps and Indigenous inventories on papers or spreadsheet are a lack of meeting these requirements which are not static and subjected to change rapidly. The Geographic Information Systems (GIS) and Database Management (DBM) System are capabilities and confined in the manipulation of location and descriptive data, respectively. A GIS system is chosen in Management Information and Infrastructure of Indigenous Communities because it's meets all the requirements that can help the authorities to managed the community. GIS able to manipulate the location and descriptive data as well as the relationships between them are dynamic. This paper will discuss briefly the conceptual design of GIS activities and Indigenous community in Royal Belum State Park, Malaysia, then terminology and theoretical concepts of GIS, Indigenous community management and the link between them are reviewed.*

Keywords: *Management, information, infrastructure, conceptual design, Indigenous community*

1. Introduction

Indigenous peoples are the original people who occupied the Malay Peninsula for centuries. Overall, there are at least 18 tribes of Indigenous people in Peninsular Malaysia where they are categorized into three main groups, Negrito (Semang), Senoi and Proto-Malay as speech and speak their customs differed from tribe others (Wikipedia, 2014). Normally, the indigenous community lives in rural areas. They earn a living by farming, hunting and searching for wild plants (Raymond, 2010). Furthermore, with the development of the country have changed their way of life especially in the economic nowadays, where mostly develop the farmland and also worked in various other sectors. Placement of Aboriginal communities in Peninsular Malaysia is one of them in Temenggor, Perak. The indigenous peoples in Royal Belum State Park, there are two major groups which are Senoi and Negrito (Hariz, 2010). A total of 5,600 Indigenous peoples who lived in Royal Belum, they are from the Jahai and Temiar tribes. The Jahai tribe is the major sub-ethnic groups among the Negrito and Temiar tribes is the major sub-ethnic groups among Senoi. In addition, the indigenous people lives in the lake of the Temenggor not use the lake for a living because there is no lake at the time of their ancestors until in 1975, they lived and meandered when Temenggor Dam Hydro-Electric is established (Journey Malaysia, 2014).

The indigenous communities in Royal Belum State Park are continued subsistence-oriented economic activities using traditional approaches for incomes. Economic activities carried out by them in terms of occupation are categorized into three sectors namely jobs from the government sector, private sector and by their own (traditional). Generally, the involvement of Indigenous peoples in traditional economic sectors, do not provide the community with a stable

income, further, making everyone in the community right now living in poverty. The majority of residents are maintaining the traditional economic activities which mostly related to the forest and fishing. The infrastructure development in this area is also to slow because of the accessibility to the villages which can only be access by boat.

Generally, the facilities have been developed with the assistance of JAKOA to provide convenience for Indigenous peoples in the village for their daily lives. The infrastructure development was started in the year 2005 such as primary school and public toilet, followed by housing project, community hall and solar system in the year 2009. Finally in the year 2010 the clinic and toy library have been developed in the village. The communities get their water supply from the river. The coverage of electricity is depending on the solar systems that need to maintain time to time.

Therefore, the purpose of this study is to develop the conceptual model of the Management Information and Infrastructure of Indigenous Communities at Royal Belum State Park using GIS platform. The research question of this study is:

1. What are the economic activities that have carried out by Indigenous peoples?
2. What are the economic strengths of the Indigenous settlements area?
3. What are the facilities provided for the Indigenous community in their settlements?
4. How to manage the data of Indigenous Community more systematic and efficiently?

Thus, to meet the purpose of this study an information management system on Indigenous communities can be developed using the application of geographic information system (GIS).

Geographic information system (GIS) is a combination of map and database that can be seen on the database table when clicked on a map. There are five components in the GIS which are the hardware, software, data collection, analysis, and peoples. In addition,

GIS software provides the functions and tools needed to store, query, display, analyze, create and modify the geographical information that have been referred. In this era of technology, users prefer to use database system rather than using conventional methods which is by using a map. By using a database system, the general information about the indigenous peoples in Royal Belum is immediately available and more convenient than using a map as socio-economic, educational, and other facilities. In addition, knowing the places of indigenous community placements using a database system, the local peoples and people from the outside country will be able to know the culture and way of life easily.

Moreover, Geographic information system (GIS) is one of the techniques to access the database system and know the information of development of Indigenous community in Royal Belum State Park especially the groups from Jahai tribes since 5 years ago. The interface of the database can be used for the user to select the information from the map. Thus, the user can get the information about the way of life, the infrastructure and others that attract tourists to visit them. The database system of the tourism gives much more advantages to the user and also gives a benefit to the other sector as well.

The advantage of using the map can increase the society especially for both government and private agencies which is to know the information of attractive location and for the other purpose. The map is a two-dimensional surface which shown the location of where lies a residential and other uses. There are many disadvantages of using a map as the information about the placement of the Indigenous community in Malaysia is limited. This is because other information about the Indigenous community such as socio-economic information, facilities, and others cannot be shown on the map. Furthermore, the information on Indigenous communities play an important role because it is a medium to introduce Indigenous culture and socioeconomic to other people. Therefore, it is can give an advantage to neither the industry nor the agency that would like to obtain information about the indigenous

community in more specific. Besides, the limited of information about the Indigenous community is causing difficulties in identifying the developments of infrastructure among indigenous communities in Royal Belum State Park. Nowadays, insufficient data on the information of infrastructure and Indigenous community in the management and administration of the community such as school type, education level and others will be caused the Indigenous community is not developed in line with the mainstream of development and modernization of our country. Therefore, a database system (GIS) is established to provide a facility to overcome the problems mentioned. The presence of GIS is capable of storing and managing attribute information database and digital cartographic data, but this system allows the data is manipulated simultaneously (Zamri, 2007).

2. Theoretical Concepts on GIS

According to Gönül Toz et.al. (1992), Geographical Information System (GIS) consists of geographical data, computer hardware, software, personnel designed to collect, storage, manage, query, analysis and present large volume of spatial data associated attributes in order to allow the users to make better decision, to improve productivity, to save time, money and manpower. Generally, the term data corresponds to discrete, recorded facts about the phenomenon from which people gain information about the real world. In the context of geography, data may be considered, as data about geographic features such as roads, buildings, river etc, and phenomena, such as weather forecast, earthquake, etc. Conventional maps provide very effective graphical information of the geographic features, but they are not very useful for supporting data retrieval (Gönül Toz, et. al., 1992). Data retrieval from the maps is usually done by a visual search, a process that is neither efficient nor reliable. Spatial analysis is more difficult to conduct, even for a simple application such as calculation the total area of the village in the State Park, the amount of manual work involved is sometimes prohibitive. A geographic information system (GIS) is a

computer-based information system that enables capture, modeling storage, retrieval, sharing manipulation, analysis, and presentation of geographical referenced data. Geographically l referenced data is a special data that relates to the surface of the earth. The basic element of GIS is database element. A database is a collection of data organized in such a way that a computer can efficiently store and retrieve the data. Any information can only be as good as its data.

Gönül Toz, et. al., (1992), stated that the sources of a GIS may be consists of conventional maps, orthophoto or photo maps, digital maps, aerial photos, satellite images, video images, land observations, cadastral records, computer-aided drawings, database files and text files. The main requirements of GIS are ability to handle multilayered, heterogeneous databases of spatially indexed data, to query the databases about the location and properties of a range of spatial objects. The GIS system requirement is the ability to manage the efficiency such as queries in an interactive mode, ability not to retrieve but also to create new information and flexibility in configuring the system in order to accommodate a variety of specific applications.

The database is the foundation of a GIS. Knowledge of the fundamental principles of databases is necessary to understand GIS technology. In order to act effectively as a data store, a computer system must have the confidence of its users. The database philosophy is an attempt to solve integrity, independences, security and other problems that occur in a traditional file processing system. The idea is to place as much of the structure of the information into the databases as possible. Databases are self-describing, as they encode both data and the structure of that data. The means of expressing the structure and relationships in the data is provided by the data model. The data model also allows the user to enter into the database any properties of the data that are expected always to be true (integrity constraints). Integrity constraints are an aid to maintaining correctness of the data in the database, because they only allow modifications to the database conform to these constraints.

3. Database Management System

The data is collected in one logical, centralized location. A database management system (DBMS) manages the database by insulting the data from uncontrolled access. A DBMS allows the definition of the data model, supports the manipulation of the data, and provides control for the two-way access channels between the exterior and the database. A database also enables a designer to define the structure of the data in the database, providing levels of authorization that permit different groups of users secure access to data. A DBMS also allows users to access the data in the database without precise knowledge of implementation details. A database can now be more precisely defined as a unified computer-based collection data, shared by authorized users, with the capability for controlled definition, access, retrieval, manipulation, and presentation of data.
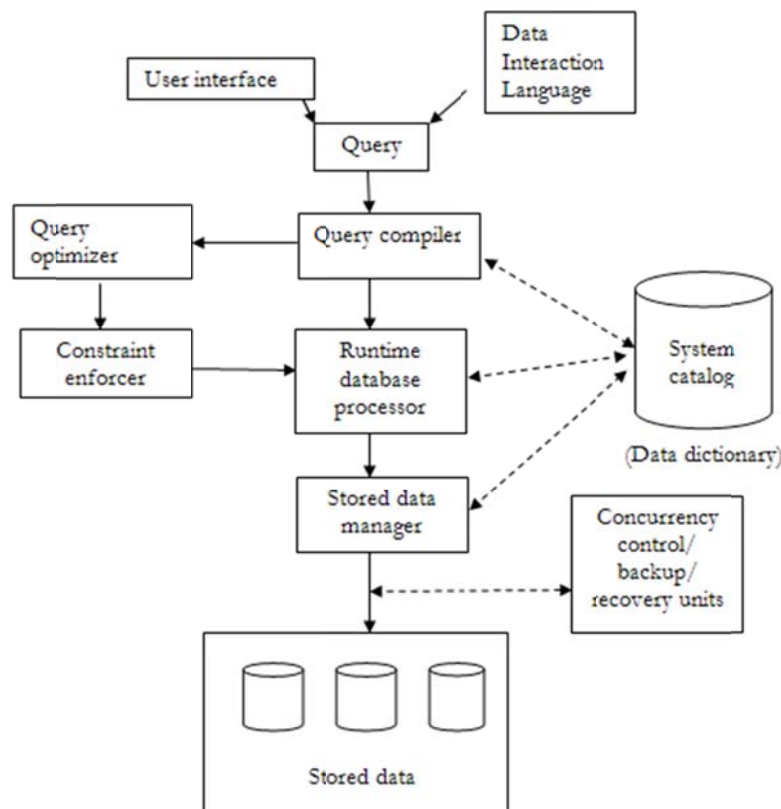

Figure 1. DBMS Components Used to Process User Queries

Figure 1 illustrates the summary of the database management system elements. Based on Figure 1, the DBMS has a query compiler that will parse and analysis the query and if all is correct, generates the execution code that is passed to the runtime database processor. Along the way, the compiler may call the query optimizer to optimize the code so that performance on the retrieval is as good as possible (usually there are several possible execution strategies). The compiler may also use the constraint enforcer to check that any modifications to the database satisfy any integrity constraints in force. Access to DBMS data is handled by the stored data manager, which calls the operating system for control of the physical access to storage devices.

Auxiliary units may be used to handle transaction management, concurrency control, backup , and recovery in the case of system failure. To retrieve the results of the query, the data that is physically located on the storage device must be mapped to the high-level objects in the query language statement. The GIS application software

may be divided into four main categories such as functions for registering, entering, storage of data and functions for correcting and adapting data for further use. In addition, GIS software may have functions for processing and analyzing data and data presentation. Figure 2 shows the foundation of GIS software.
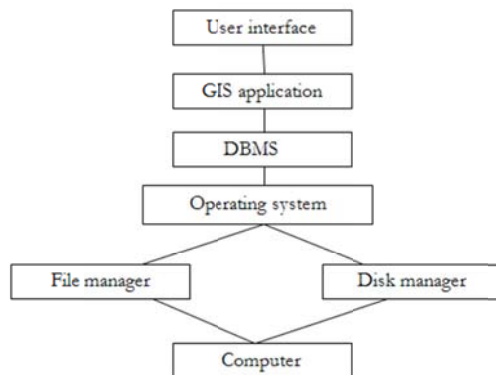

Figure 2. Foundation of GIS Software

From Figure 2, the user interface is creating to present the information and graphics in interesting and interactive visualization and make the system friendlier to the user. Users and computers communicate at the human-machine interface. Which, the human-machine are vital in GIS application, where users need to control communications, where users need to control communications with their computers by deciding what is to be done at what time and order? A database comprises one or more files that are structured in a particular way by a DBMS and accessed through it. A DBMS can, therefore, be defined as a software package for storage, manipulation, and retrieval of data from a database. An operating system is a basic program that administers the internal data processing in a computer.

4. Application of GIS in Managing Indigenous Community

The location and descriptive data with the relationships between them are required in the Indigenous community management activities. All of these data and relationships can be regarded as geographical information which is subjected to change dynamically

(Gönül Toz et.al., 1992). Conventionally, the location data such as coordinate, houses, location of the infrastructure can be identifying on a map. While, the attributes data are composed of conventional inventory which describe the population, economic growth, and demographic etc. Neither, traditional map or indigenous inventories are sufficient enough to supply the location and descriptive data. The information and data are changing every year and updating the map and inventories is rather cumbersome and time consuming. A GIS is the best choice to apply in Indigenous community management, for it is able to manipulate the location, attributes data and the relationship between them dynamically.

For example Tarmiji, Fujimaki and Norhasimah (2010), have conducted a research involving indigenous community using Geographic Information System (GIS) in Peninsular Malaysia: Population, Spatial Distribution, and Socioeconomic Condition. This research is about representing the Indigenous people population in the form of spatial distribution mapping using ArcGIS 10.0 software. The final product is two types of map, which are the map showed the concentration of Indigenous people population by states for 1947, 1957, 1970, 1980, 1991, 2000 and 2010. The other map showed the increasing and decreasing of the Indigenous people population growth rate between 1947 and 2010. The advantage of this research is the using of GIS to present the information of Indigenous people in Peninsular Malaysia. The information involved in this research is only about Population of Indigenous people. However, this research did not insert the infrastructure information of the Indigenous community.

Hanina, Asnarulkhadi and Ja'afar (2011) has presented the information of Indigenous people on nine selected village around Peninsular Malaysia by using MapInfo and Arc View software. The information involved basic information, information on economic activities, information on connecting road between the settlements with the city, and community inventory. The advantage of this research is the final product is in the form of digital maps. However, the infrastructure that has been presented in this research is only the road or

access to the settlements. There is no information about the other infrastructures in the village area.

Liman (2005) has conducted a research entitle Web-based Information System for Land Management, Case Study: Indigenous Community in Yukon Canada. The final result of this research is web-based GIS applications consisting of spatial and legal information related to Indigenous land development and management. The information presented is traditional territory data which show the traditional boundaries of Indigenous Communities. Another information is land settlement data which provide ownership information for land parcels. The information also includes the connecting road between the settlements with the city. However, the infrastructure that has been presented in this research is only the road or access to the settlements. There is no information about the other infrastructures in the village area.

5. The Conceptual Design

Belum Indigenous Community Information and Infrastructure System (BELUMICIIS) is GIS application software for Indigenous Community management activities in Royal Belum State Park. The main GIS software package will be used to develop the database by using Quantum GIS software, which is open-source software. The software provides a continuously growing number of capabilities provided by core functions and plug-in. This software can visualize, manage, edit, analyze data and compose printable maps.

There are two types of data would be used in the BELUMICIIS namely spatial and attribute data. Spatial data will be classified into several layers, which are layers of Royal Belum State Park base map, village layer, demographic layer, infrastructure layers and map area layers. The attribute data will be added in the stated layers such as demographic data, economic structure and performance, accessibility and infrastructure inventory. BELUMICIIS geographical database consists of both location and inventory data. The location data will manually digitize cover type of the maps at Royal Belum Forest. The BELUMICIIS

project has been organized into four aspects of Indigenous community management such as design, inventory, implementation, and validation. The first stage was to build the database by designing the conceptual idea of the GIS package. The conceptual design of the BELUMICIIS package is related to an entity-relationship diagram (ER-diagram). ER-diagram created to represent the entities, attributes, and relationships graphically. Building an ER-diagram may help improving the acquisition of data at the study area.

This study consists of four entities such as a clinic, house, school and community facilities – see Figure 3. Based on Figure 3, the entities data for clinic consists of demographic information such the location, number of a clinic, the number of doctors and nurses. While the entities for house will consists of the name of the owner, type of houses, the occupation and income of the owner, facilities etc. The entity of school consists of the name of the school, facilities, the number of teachers, numbers of students etc. Lastly, the communities facilities are consist of location, capacity, size, type and name of the facilities in the village. All the entities are a need for the database development. It is the process of constructing model information that can be mapped into storage objects by the DBMS.

The second phase is to get the inventory information such as demographic information, community facilities, and maps. The demographic information data of the Indigenous people will be collected by using a survey form. The people information and village infrastructure data will be collected from the Department of Indegenous Community Development (JAKOA). Meanwhile, the Royal Belum State Park's map and the village's map will be collected from the Survey and Mapping Department. The location of the infrastructure and houses will be collected by using Global Navigation Satellite System and Total Station technique. All the map on hard copy will be scanned and the file format will be converted from raster into the vector format for the process of digitizing.
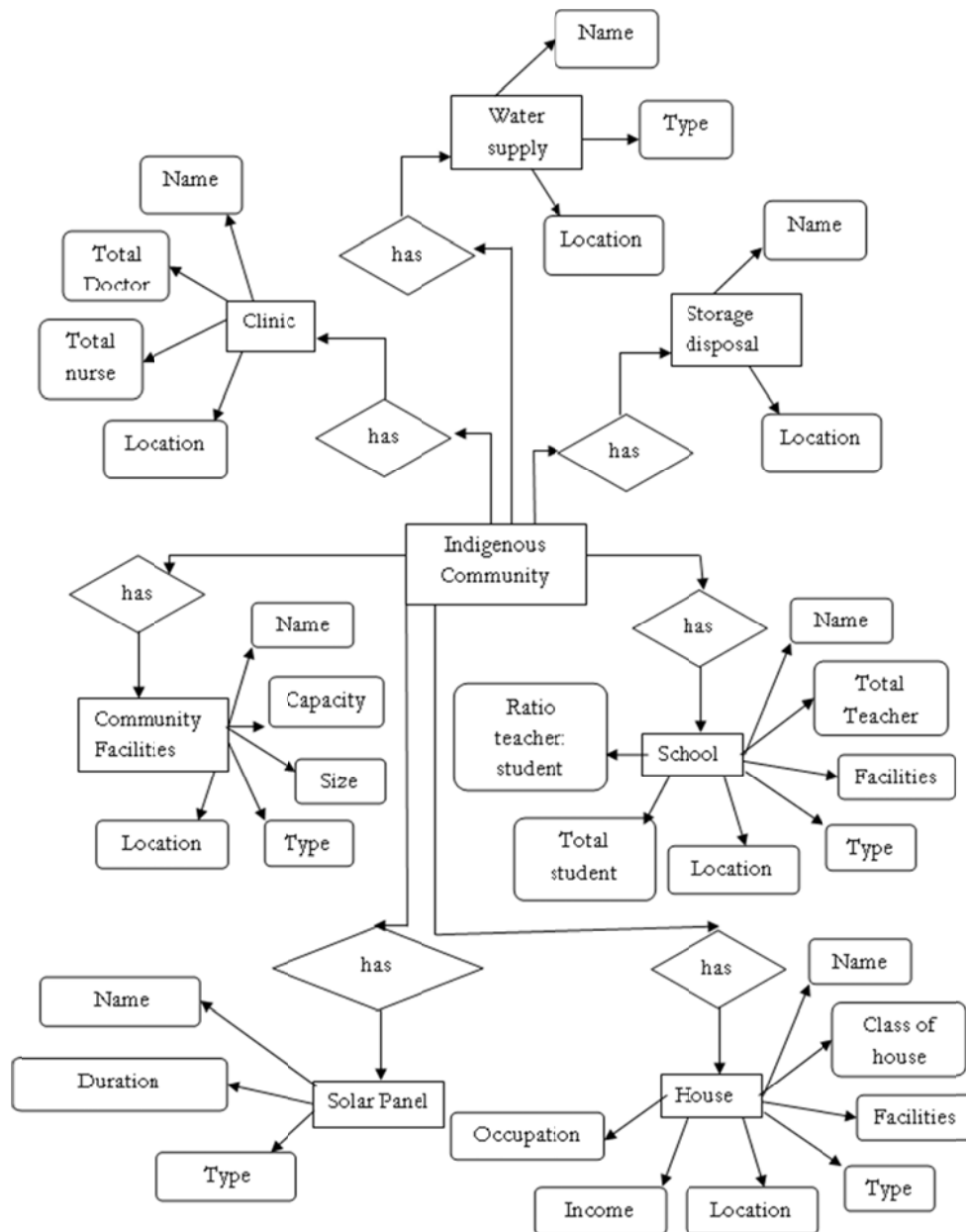
Figure 3. Conceptual Design of BELUMICIIS

The third phase is the implementation part whereby the collected data will be analyzed first to identify the type of data is either composed of spatial data and non-spatial data. Spatial data are a data that consist of layers of maps. While non-spatial data consists of attributes data. Both of these data will be combined to obtain a composite geospatial data and it will be separated into several tables in the database. Another requirement should be considered is the hardware and software used. At the end of the design, related functions will be identified in detail. In addition, it will explain how the database can solve a problem. This will involve the interaction between users and databases. The aspects to be taken into account in the final design are appropriate graphical interfaces and user-friendly design to attract more users to use this database. The final stage is to validate the BELUMICIIS. This stage is implementing to test the effectiveness and the usability of the system.

6. Conclusion

Traditional maps and inventory data are not sufficient to meet all the Indigenous community activities. The conventional method have prove that map and inventories give very limited information and have to take into account the others parameter such as time, costing, manpower, productivity etc. Based on the literature review, there is need to continue this study because, there is still not enough studies have been carried out relating to the management of information and infrastructure of indigenous community either in Malaysia or internationally. Furthermore, there is still no GIS applications are being implemented in Indigenous Community in Royal Belum State Park, Malaysia. It is hoped that this GIS application can help the authorities to collect and analyze the information. While creating the Indigenous community plans, information required can be obtained from BELUMICIIS information system. Maps and report answering to custom queries covering defined Indigenous community area are to be created and presented, more accurately, more quickly and more rentable as compared with conventional methods.

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