ICESTI SPringer

by Viny M

Surakarta Cultural Heritage Management Based on Geographic Information Systems

Ery Dewayani[1] and Viny Christanti M.[2,*]

[1,2] Faculty of Information Technology, Tarumanagara University

Jl. Letjen. S. Parman no. 1, Jakarta, Indonesia

* Corresponding E-mail: viny@untar.ac.id

Abstract   Tangible cultural heritage is the legacy of physical artifacts from past generation in a nation. Indonesia is a nation which is rich in cultural heritage. Surakarta is a city that has a lot of historic buildings and other physical cultural heritage. Preservation of the cultural heritage of Surakarta can be done in various ways. One way to preserve it is to create an integrated documentation and renewable. In this research, we try to build Geographical Information System (GIS) based on web. The making of GIS of Surakarta cultural heritage, intended to facilitate the inventory, monitoring, follow-up and can be used as a reference for determining policy related to the cultural heritage conservation. Surakarta GIS is complemented with a function to register the historical heritage. Registration can be done by either the local community or the manager of the historical heritage. This function can also assist the government in obtaining the data of other historical heritages that have not been registered, so that the heritage can be protected by the government. The system is built using MapServer and PostgreSQL to manage spatial data.

Keywords: Geographic Information System, MapServer, PostgreSQL, Surakarta, Tangible Cultural Heritage

Introduction

Indonesia is a nation that has a lot of cultural heritage. Surakarta is one of the cities that have a history of high heritage value and become the city's identity, so that the building and the region must be preserved [1]. Surakarta have many physical cultural heritage, especially physically immovable cultural heritage. National culture is something that must be preserved as a heritage and that preservation was done for the sustainability of this nation. Preservation of culture can be done in different ways. From maintaining, promoting and pass them from generation to

generation. The cultural heritage itself can consist of two major categories i.e. tangible cultural heritage and intangible cultural heritage [2]. While on The World Heritage Convention article 1, tangible cultural heritage consist of 3 categories, i.e. monument, groups of buildings and sites [3].

Preserving means maintain for a very long time, because it can be imagined if 5 or 10 years again, the cultural heritage may no longer exist or have changed into another form. For example in Italy, the criteria and the aims of protection have changed, so that it does not tend only to preserve and manage the existing assets as well as to proceed with legal and administrative measures, but also to exploit the assets through a more complete knowledge of them [4]. Preservation effort is a maintenance effort for a very long time. Therefore, it is necessary to develop conservation as a sustained effort.

Computers can be used as a place of gathering, archiving, management, analysis and generate output geographic shape [5]. The use of these technologies can enable people to access and disseminate information. One of the ideas that can be developed is the manufacture of GIS for mapping the physical cultural heritage in Surakarta and surrounding region. The system built implemented for: (a) the acquisition and verification of data, (b) the compilation of data, (c) the storage of data, (d) changes or updating of data, (e) management and data exchange, (g) access and data presentation.

Geographic Information System (GIS) will map each activity related to spatial data and associated with the local geography. Hopefully, this mapping can give an idea or information on activities occurring graphically linked with the condition of the cultural heritage in Surakarta and surrounding areas. The purpose of this system is to provide information that can be used by public and private agencies designated to protect and utilize the cultural heritage (such as architects, archaeologists, historians and others). Moreover, it can also be used by ordinary people who are interested in cultural heritage.

In this study, the collaboration process has been conducted with the Department of Spatial Planning (*Dinas Tata Ruang Kota*) and the Department of Tourism (*Dinas Pariwisata*) of Surakarta. This collaboration has been established for 2 years. Data collection and data analysis is done intensively in 2014. Based on interview with some of managers of historical tourism destination and Head Section of Maintenance and Protection Zone and Heritage Buildings City Hall Surakarta, they state that there are some of objects not registered as cultural heritage. So the government cannot protect this object, although the object is historical object.

Cultural Heritage

Based on article 1 of Law No. 5 of 1992, an object can be referred to as 'objects of cultural heritage' is man-made objects and natural objects which are moveable or not moveable, that are considered to have significant value for the history, science and culture [6]. While the location that containing or suspected to be the objects of cultural heritage called 'sites'. Based on world heritage in 1995, cultural

heritage consist of three categories, there are monuments, groups of buildings and sites [3].

In general, people familiar with the cultural heritage is an ancient building which is protected by the government. But more broadly, cultural heritage is preserved by the local communities and the livelihoods are protected by law from the danger of extinction. Based on the analysis and field research, not the entire physical cultural heritage is protected by the government. There is some physical cultural heritage that has not been included in the cultural heritage so that the heritage is not protected by the government.

People who become owners or managers of buildings and areas of cultural heritage have rights and obligations to register the object. Once the object has been examined and declared complies with the requirements of the cultural heritage, then the object will get the sign in the form of a label that is placed near the object. Label is a sign that the object is registered in the government's decree of cultural heritage and the right to be protected.

Surakarta Cultural Heritage

Thomas Karsten, a Dutch architect who also designed a number of ancient buildings in Surakarta say, a process that must be done before setting Surakarta as objects of cultural heritage is mapped the historic district. There are three classes that distinguish; first class is two palace complexes in Surakarta (Mangkunegaran and Pakubuanan), class two ancient buildings around the first grade and third grade are other ancient buildings beyond first class and second class [7].

The first class of the region shall be maintained the original form of the building, for any reason in these places should not be reduced or plus building. While in the second grade covers an area around the first-class area that still has the old city structure and contains ancient buildings. This area also includes the former European residential, Pacinan, Kampung Laweyan and so on. Preservation of ancient buildings can be done through four forms of conservation, among others Preservation, Rehabilitation, Reconstruction and Revitalization [6].

The determination of the direction of preservation for potential building done by classifying potential building into two, namely the high potential and low potential [8]. Categorization of buildings into a high or low potential status can be viewed from various aspects of assessment. Aspects of the assessment can be determined based on the value of cultural meaning and condition of the building or object. The assessment process carried out beforehand by experts of cultural heritage.

At this time The Department of Spatial Planning of Surakarta not has sufficient documentation to support the Surakarta cultural information, especially regarding to the physical cultural heritage. Therefore, we collect all the primary and secondary data. Primary data collected directly in the field to do a photo shoot and interviews with locals. While secondary data obtained from The Department of Spatial Planning in the form of printed document.

Geographic Information System

Geographic Information Systems (GIS) is defined as a component which consists of hardware, software, geographic data and human resources that work together effectively to capture, store, repair, update, manage, manipulate, integrate, analyze, and display data in a geographic-based information [5]. To get spatial information, GIS using location within a particular coordinate system, as a basic reference. Therefore, GIS has the ability to connect various data at a given point on each combine, analyze and finally mapped the results. GIS answer some questions such as: location, condition, trends, patterns, and modeling. These abilities are exactly what differentiate GIS from other information system.

Meanwhile, according to other sources, GIS is a set of computer hardware, software, data and people are combined to address spatial-based questions and provide new ways of looking at the GIS to find solutions or make decisions [9]. Based on these GIS functions, the GIS become a tool to preserve the cultural heritage. Data can be stored cultural heritage, renewable and known by the public. Cultural heritage which has changed shape, missing or unknown can still be traced back to this system.

Spatial and Non Spatial Database

Building a database to GIS is divided into two parts, namely spatial and non spatial database. GIS spatial database for this culture is built based on the results of data collection has been done in the previous year's study. Layer on the base map used is sub-district, district, provincial and village. Other spatial data classification carried out in several categories. Classification layer is the stage of grouping elements of spatial data in accordance with the theme of each.

At this GIS data classification carried into five parts, namely the reserve is not a tourist, not a cultural heritage tourist attractions, heritage sites, historical buildings and tourist attractions of historic buildings [10]. The purpose of this division is to locate the physical cultural heritage that has become the reserve or not, physical cultural heritage that are well known and become tourist attractions or just a cultural heritage of historic buildings.

As for non-spatial data, compiled based on data collected in the previous year's research. This Surakarta culture heritage GIS focuses on the registration process of cultural heritage. Heritage Surakarta divided into several categories. Data have been obtained from the study of literature, has been analyzed and can be divided into three categories: Labeling, Object Types and Forms conservation [6, 10]. In table 1 we can see the contents of each category.

Next analysis is that the cultural heritage can be registered by: owner, family, business or other. This analysis done based on SK. No: 646/116/1/1997 about Determination of the buildings and the historical ancient region on Surakarta Municipality level II. People who become owners or managers of buildings and areas of cultural heritage have rights and obligations as specified in local regulations on

cultural preservation. The owner of cultural heritage are entitled to legal protection in the form of a Certificate of Cultural Heritage and Status Certificate of Ownership is based on evidence, which was made by the local work unit that has tasks and functions in the field of cultural heritage.

Table 1 Category of cultural heritage based on Surakarta Department of Spatial Planning.

No	Categories	Description
1	Labeling	*Tugu , Tembaga, Granit*
2	Type of object	Traditional area: traditional and non-traditional
		Traditional house
		Colonial public building
		Worship building
		Gapura, Tugu, Monumen, Perabot Jalan
		Open Space: *Makam*, Park, Open Garden and Open space
3	Conservation	Preservation, Rehabilitation, Revitalization, Reconstruction

Geographical Information System of the Surakarta Cultural Heritage

After the database is built, there should be an analysis of the needs of software and hardware to build a website. Specifications of the software that used to build a GIS divided into two sides, server side and client side. We build Surakarta GIS in Ubuntu 14.04 operating system environment. PostgreSQL with PostGIS extension is used as software for database management system. For map management and visualization, we use MapServer. At client server, user only need web browser. PostgreSQL and MapServer is open source software that support and facilitate the making of GIS [11].

GIS system is built with the main purpose to preserve the physical cultural heritage city of Surakarta. As is known physical cultural heritage can be a monument, groups of buildings and sites. This legacy can be a private, family or in open spaces. Therefore, the government itself gave the opportunity to register the heritage to be protected by law.

In this GIS system, the data of cultural heritage is presented complete with the history, location and label of the cultural heritage. Results of this GIS will connect the process of enrollment, management and storage of data with the physical cultural heritage map of the city of Surakarta. Each user can see where the location 5 the physical cultural heritage. The success of this research is expected to help in the preservation of the cultural heritage, in particular the physical cultural heritage in Surakarta and surrounding region. The Department of Spatial Planning and the Department of Tourism are expecting that this research could be implemented by the Surakarta government.

Result and Analysis

Data collection has been carried out and managed to find 74 locations of cultural heritage, and the data obtained some 62 photos of cultural heritage, cultural heritage label and the coordinates of its location. A total of 7 label of cultural heritage is not acquired by obstacles, such as heritage label is not installed, not found the location label reserve, requires permission from the owner or location of heritage buildings are being used for an activity. At table 2 we can see the example of location, coordinate data of Surakarta cultural heritage and distance between location and tourism destination.

Table 2 List of cultural heritage location, complete with coordinate and distance to other destination.

No	Location	Destination	Distance
1	Bandara Adisucipto Yogyakarta	Candi Sambisari	3.1 km
	Coordinate :	Candi Prambanan	7.8 km
	S -7° 47.1219', E 110° 26.2233'	Museum Prambanan	8.6 km
	address:	Candi Plaosan	10.2 km
	Raya Solo KM. 9, 55282, Indonesia	Ratu Bokoh	9. 7 km
2	Candi Sambisari	Candi Prambanan	9.2 km
	Coordinate:		
	S 07°45.811', E 110°26.797'	Museum Prambanan	10 km
	address:	Candi Plaosan	11.6 km
	Desa Sambisari Kelurahan Purwomartani		
	Jalan Nasional 15		
	Depok, Sleman, Yogyakarta 55281, Indonesia	Ratu Bokoh	11.1 km

Review the location, shooting and coordinate reserve, guided by the management staff of cultural heritage label assigned by the Department of Spatial Surakarta. In addition, based on the observation, then there are 19 historic sites are considered to be a tourist attraction. That historic place is a place most often become a tourist destination by domestic and foreign tourists. The picture of cultural heritage and its label can be seen at table 3.

Table 3 Example pictures of the historic heritage of Surakarta.

No.	Cultural heritage name	Coordinate	Photo	Label
1	Tugu Lilin Kelurahan Penumping	S 07°34'07.2" E 110°48'19.8"		

2	Patung Slamet Riyadi Jalan Slamet Riyadi	S 07°33'55.3" E 110°48'19.1"		

When collected Surakarta data is done, we analyze the data, and then we found some facts that not all the historic place is the cultural heritage. Like, Mangkunegaran palace is one of the cultural heritages listed in SK No. 646/101-F/1/2012 and also became one of the most visited tourist attractions. Whereas Prambanan temple and museum is not listed as a cultural heritage though it is tourism place. Museum Radya Pustaka is listed as a cultural heritage place, but not as tourism place.

Geographical Information System of The Surakarta Cultural Heritage has following functions: display a map, pan and zoom throughout a map, identify features on a map by pointing at them, culture heritage registration, manage all culture heritage data and others. Surakarta GIS is divided into two sides of the admin and user. Admin side is for managers of Department of Spatial Planning Surakarta. Admin has functions to add, update and manage existing data.

The user side is the public at society, especially society the city of Surakarta. User can see information, history, photo and location of culture heritage. The users can also make the registration process of the cultural heritage that has not been registered in government offices. Registered cultural heritage will be reviewed by government agencies. If it has met the requirements listed in the law then the heritage will get a decree from the government.

Fig. 1. Surakarta Map and the map legend.

Fig. 2. Lists of cultural heritage.

8

Fig. 3. Categories of cultural heritage.   **Fig. 4. Information of cultural heritage.**

Figure 1 consists of a map of Surakarta and legends from one of the cultural heritage objects. Figure 2 is admin side that has list of cultural heritage. At figure 3 we can see categories of cultural heritage object that consist of tourism cultural heritage, tourism not cultural heritage and tourism historic building. the distribution of these categories, helping people to see the tourist attractions which have not become cultural heritage or cultural heritage which has not been promoted as a tourist or historic buildings which have not been registered as a cultural heritage. At figure 4 we can see the information of cultural heritage.

Conclusion

This study has successfully collected data historic sites and cultural heritage is based on regulations in Surakarta. Such data has been validated directly to the informant. Researchers also managed to collect primary data and secondary data in accordance with the data recorded in the local government. The original data in the form of complete documents obtained directly from the Department of Spatial Surakarta.

Surakarta GIS is complemented with a function to register the historical heritage. Registration can be done by either the local community or the manager of the historical heritage. This function can also assist the government in obtaining the data of other historical heritage that have not been registered in order to be protected by the government.

GIS Culture Surakarta already meets the required specification data analysis. Implementation is done to Department of Spatial Planning Surakarta. Expected results of this GIS can be beneficial and improve the affection of the people of the physical cultural heritage of the city of Surakarta. Building a GIS system, is as a proof of the government's attention to the physical cultural heritage of this nation. Hopefully, this concept of GIS can be implemented for other cities.

References

[1] Setyaningsih, Wiwik. "Potensi Spasial Fisik Kampung Kauman Surakarta sebagai Kawasan Budaya dan Religi". GEMA TEKNIK Majalah Ilmiah Teknik 10, no. 2 (2009): pp-119.

[2] Galla, A. 2001. Guidebook for the Participation of Young People in Heritage. Conservation. Brisbane: Hall and jones Advertising.

[3] World Heritage Unit. 1995. *Australia's World Heritage*. Canberra: Department of Environment, Sports and Territories

[4] Bartolotta, Michelangelo, Sabrina Di Naro, M. Brutto, and B. Villa. "Information systems for preservation of cultural heritage." *International Archives of Photogrammetry and Remote Sensing* 33, no. B5/1 (2000): 864-870.

[5] Bernhardsen, T. "Geographic Information Systems–An Introduction, John Wiley & Sons." *Inc., Toronto* (1999).

[6] Indonesia, Departemen Kebudayaan. *Undang-undang Republik Indonesia Nomor 5 Tahun 1992 Tentang Benda Cagar Budaya (Law no. 5 Concerning Cultural Object)*. Kementerian Pendidikan dan Ke-budayaan, Republik Indonesia, 1992.

[7] Rosyid, Imron. Kota Solo Diusulkan jadi Kota Cagar Budaya. Tempo, 13 January, 2007.

[8] Hariyani, Septiana, Antariksa Antariksa, and Andri Satrio Pratomo. "Pelestarian Kawasan Kampung Batik Laweyan Kota Surakar-ta." *DIMENSI (Journal of Architecture and Built Environment)* 34, no. 2 (2007): pp-93.

[9] Petrescu, Florian. "The use of GIS technology in cultural heritage." In *Proceedings of the XXI International CIPA Symposium, Athens, Greece*, pp. 01-06. 2007.

[10] Dewayani, Ery, et.al. "Pemodelan Sistem Informasi Geografis untuk Pemetaan Warisan Budaya Fisik di Wilayah Surakarta dan Seki-tarnya." In *Proceeding of the Digital Information System Conference 2014*, Bandung, Indonesia.

[11] Duran, Z., Garagon Dogru, A., Toz, G., 2003. Cultural Heritage Preservation Using Internet-Enabled GIS, CIPA 2003 XIXth International Symposium, 30 September – 04 October, 2003, Antalya, Turkey.

ICESTI SPringer

6% SIMILARITY INDEX

5% INTERNET SOURCES

3% PUBLICATIONS

2% STUDENT PAPERS

PRIMARY SOURCES

1	Budi Santoso, Bambang Waluyo Hadi Eko Prasetiyono. "Planning Of Beef Cattle Development in District Blora, Central Java, Indonesia", E3S Web of Conferences, 2018 Publication	1%
2	www.isprs.org Internet Source	1%
3	repository.unimal.ac.id Internet Source	1%
4	Submitted to Informatics Education Limited Student Paper	1%
5	docplayer.net Internet Source	1%
6	Submitted to Tarumanagara University Student Paper	1%
7	repository.wima.ac.id Internet Source	<1%
8	"Suitability of Nutmeg Plant Habitats in Three Nutmeg Production Centers using the	<1%

Geographic Information System and Aster DEM in West Java, Indonesia", International Journal of Innovative Technology and Exploring Engineering, 2019
Publication

9   Aldilano Bella Marlintha, Budhi Irawan, Roswan Latuconsina. "Design and implementation of smart village mapping geographic information system based web in the cinunuk village", 2017 IEEE Asia Pacific Conference on Wireless and Mobile (APWiMob), 2017   <1%
Publication

10   gis-mapping-system.blogspot.com   <1%
Internet Source

11   "Transdisciplinary Multispectral Modeling and Cooperation for the Preservation of Cultural Heritage", Springer Science and Business Media LLC, 2019   <1%
Publication

Exclude quotes   On   Exclude matches   Off
Exclude bibliography   On