

GEOVISUALIZATION METHODS FOR CULTURAL AND HISTORICAL SIGHTS

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ABSTRACT

This paper describes the process of creating a useful geographic information system (GIS) viewer on the web that shows the map of the old town of Šibenik, which is located in the heart of Dalmatia. Spatial and attribute data is the core of every geoinformation system so therefore a database with objects of interest (cultural and historical sights in the old town centre) was created. The main goal of the project was to develop a GIS viewer for tourist purposes, but also to provide basic information about the current situation of building for investors and conservators. The rules of cartographic generalization, visualization and digital cartography were taken into account. The paper will describe theoretical and practical aspects of creating a geoinformation system. The theoretical part explains basic terms such as web cartography, web maps, databases and geoinformation systems. The practical part shows the working process which goes from collecting the data and processing it into the database, to creating the map and publishing it on the Internet.

Keywords: web map, database, GIS of cultural and historical sights

INTRODUCTION

Located in the central part of the Croatian Adriatic Coast with approximately 47 thousand inhabitants, Šibenik is the administrative, political, economic and cultural centre of the County of Šibenik and Knin. It is the oldest native Croatian city on the Adriatic because it was founded by Croats and not like most other cities by Greeks, Romans or Illyrians [1]. North of the city lies the Krka National Park and on the west is the Kornati archipelago, also a natural park with around 150 islands. Šibenik is known for being under foreign rule and occupation and has therefore lots of historical landmarks. It is the only Croatian city with two UNESCO (United Nations Educational, Scientific and Cultural Organization) world heritage sites [2], namely the St. James Cathedral (Fig. 1) and the Fort of St. Nikola. Šibenik is nowadays popular for its numerous festivals and concerts. Because of all aforementioned facts tourism plays a significant part in the economy of the city.



Figure 1. *St James Cathedral* [3]

In order to be successful in the tourism industry a city like Šibenik has to inform tourist about cultural venues and attractions. On the other hand, considering all the historical sights inside the old town, it is necessary to provide investors and conservators with up to date information about buildings. Being rich in cultural and historical treasures carries responsibility to invest in the revitalization of buildings and conservation of heritage. The prove that in recent years awareness for cultural and historical heritage rises is the fact that the Organization for conservation of cultural heritage in Šibenik ‘Juraj Dalmatinac’ started a project to build an information system of the old town of Šibenik. Nearly all 2 thousand buildings within the old town should get an identification card with attributes, photographs and guidelines for conservation [4].

MATERIALS AND METHODS

There definition of cartography has changed through the years. According to International Cartographic Association (ICA) cartography is ‘the discipline dealing with the art, science and technology of making and using maps’ [5]. Another definition specifies cartography as the science, art and ethics of the production of maps and presentations related to maps, and of their usage. As technology is rapidly changing in recent years so has the science of cartography been enlarged with new media, tools and methods [6]. Therefore, updating the definition of cartography is one of the objectives of the ICA Strategic Plan for 2011–2019 [7].

The Internet is the main medium reshaping digital cartography. The World Wide Web (also shorter called Web) is part of the Internet. It is a service that every cartographer uses in the production, usage, visualisation and publishing of digital cartographic products. Web cartography is a modern approach to cartography that makes it easier to access and manipulate geospatial information via Internet. It makes it possible for everyone who has access to the Internet to present his/her own data (or map) to others in an interesting and

pleasant way, or to access the data (or map) offered by someone else in a very simple way [6]. Maps on the web (web maps) are the most popular cartographic product because of their numerous upsides, i.e. they are easy to use, available to everyone with web access and the production costs are minimized compared to paper maps. In the days of extensive smartphone usage web maps also serve as an orientation guide in new surroundings. Easier orientation and quick location search are very important to tourist coming to an unknown city. The use of web maps in this project was motivated by the growing number of tourist walking through the streets of Šibenik, holding their smartphones and searching for a specific location (object).

Like cartography, when it comes GIS it is difficult to give a unique definition. There are different definitions because GIS can have different functions and purposes. One of the most common definition is that GIS is ‘an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information.’ [8] For our specific purpose we decided to create a web GIS viewer. Firstly, with having a viewer we wanted to retain simplicity and secondly, by publishing it on the web we tried to reach as many interested persons as possible.

Before starting with the practical part, left to define was the exact area of research and the scope of objects (Points of interest – POI) we wanted to include inside our database. As to the area of research we decided upon the medieval old town centre (Fig. 2). As to the scope of POI we used the Registry of cultural heritage led by the Ministry of Culture which contains a list of protected cultural properties [9].



Figure 2. *Are of research* [10]

The first step in the creation of our geoinformation system was collecting all the information about our POI. To start gathering data an attribute scheme had to be defined. For all buildings basic information was collected, i.e. year of construction, address, author, type of cultural heritage. In addition to basic information we collected information about construction elements like current state, material, number of floors and façade, as well as style characteristics like construction purpose, specific features (e.g. pillars) and artistic period. Data was obtained on-site by examination of selected buildings as well as by retrieving information at the Šibenik City Museum and the Conservation department

of the Ministry of Culture in Šibenik. In total we collected data for 52 objects - churches, fortresses, monasteries, palaces, centuries-old preserved buildings and a theatre. Data was collected periodically from April to August 2017. Photographs were taken using a Samsung Galaxy S3 smartphone or retrieved via web. The collected data was processed using Microsoft Excel and saved inside a *csv* (Comma Separated Values) file. Additionally, we have created identification cards for all objects which will be browsable within our GIS (Fig. 3).



Figure 3. *ID card of St. James Cathedral*

The next step was to create our web map. After considering all available software we decided to use the well-known open source desktop GIS software Quantum GIS (QGIS) 2.18 – Las Palmas. In addition, two plugins had to be downloaded from the QGIS plugins repository to create the web map, namely ‘OpenLayers Plugin’ and ‘QGIS2Web’. The first plugin makes it possible to load base maps like Google Maps or OpenStreetMap into QGIS and the second exports the current map with all layers to a web map.

As the map projection of our project in QGIS we used the official map projection of Croatia (HTRS96/TM) due to the small research area. We added three base layers from the geoportal of the State Geodetic Administration in form of a Web Map Service (WMS). Because the GIS viewer is intended for all types of users a digital orthophoto map (Digitalni ortofoto - DOF) is used as the primary base layer. The other two added base layers were topographic maps in scale 1: 5000 (Hrvatska osnovna karta - HOK) and (Topografska karta - TK25) 1: 25000. A vector layer ‘objekti’ was created for objects as points. In addition, streets (‘ulice’) and roads (‘ceste’) were created in form of line layers and parking lots (‘parkinzi’) as a polygon layer. These additional layers were primarily added to give the users an orientation guide. The coordinates of objects that represent the cultural and historical sights were located in two steps. First, we have filtered out

OpenStreetMap data, which was added using the ‘OpenLayers Plugin’, and added every object individually into the point layer. Second, object locations were checked using DOF and HOK. An attribute table was created for object names. This attribute table was the primary key for joining our created database with the points on the map. In this way we extended the attribute table so that the point layer contained all gathered data for the web map (Fig. 4).

	naziv	GODINA	ADRESA	KLASA	VRSTA	UNESCO	AUTOR	OPIS DOBRA
27	KNEŽEV DVOR	15. st.		Profana gradit...	Nepokretno k...			Sklop građev...
28	KUĆA BEROVIĆ	14. st. - 18. st.		Profana gradit...	Nepokretno k...		Pretpostavlja ...	Sklop kuća sa...
29	KUĆA CHIABOV	15. st.	Roberta Visia...	Profana gradit...	Nepokretno k...			Kuću je u 15. ...
30	KUĆA DRAGANIĆ - MARENZZI	15. st. - 18. st.	Trg palih Šibe...	Profana gradit...	Nepokretno k...			Kuća je sagra...
31	KUĆA GOJANOVIĆ	14. st. - 19. st.	Trg Medulić	Profana gradit...	Nepokretno k...			Izgledom glav...
32	KUĆA JEŽINA	15. st. - 19. st.		Profana gradit...	Nepokretno k...			Kuća ježina s...
33	KUĆA NIKOLE TOMASSEA	18. st.	Ulica Nikole T...	Profana gradit...	Nepokretno k...			kuća je barok...
34	KUĆA POLETTI - DELJAC	15. st. - 18. st.	Ivana Lukačić...	Profana gradit...	Nepokretno k...			Na kući je naj...
35	KUĆA PRVE HRVATSKE OPĆINSKE UPR...	13. st. - 20. st.		Profana gradit...	Nepokretno k...			Trokutasti skl...
36	KUĆA ROBERTA VISIANDA	15. st. - 18. st.	Roberta Visia...	Profana gradit...	Nepokretno k...			Kuća poznato...
37	KUĆA ŠTRKALJ	14. st. - 15. st.	Jurja Barakovića	Profana gradit...	Nepokretno k...			Nalazi se na s...
38	Kuća Žaja	15. st. - 18. st.		Profana gradit...	Nepokretno k...			Gotički objek...
39	KUĆA ŽAJA - CRISTOFOLO	15. st. - 18. st.	Ulica Dobrić 4	Profana gradit...	Nepokretno k...			Nastala u kas...
40	NOVA CRKVA S DVORANOM BRATOVŠ...	15. st. - 18. st.	Ulica Nove crkve	Sakralno - pr...	Nepokretno k...		Nikola Firentin...	Renesansna j...
41	OSTACI GOTIČKO - RENESANSNE PAL...	14. st. - 15. st.		Profana gradit...	Nepokretno k...			Od palača su ...
42	OSTACI PALAČE	15. st.	Ulica Roberta ...	Profana gradit...	Nepokretno k...			Na zapadnoj f...
43	PALAČA DIVNIĆ	15. st. - 19. st.	Dobrić 2	Profana gradit...	Nepokretno k...			Nakon preinak...
44	PALAČA GALBIANI	15. st. - 17. st.	Ivana Pribisla...	Profana gradit...	Nepokretno k...			Reprezentativ...
45	PALAČA GOGALA							
46	PALAČA KOŽUL	14. st. - 15. st.	Andrije Kadića...	Profana gradit...	Nepokretno k...			Palača je gra...
47	PALAČA MATTIAZZI	1884.		Profana gradit...	Nepokretno k...			Reprezentativ...
48	PALAČA PELLEGRINI - TAMBAČA	15. st. - 16. st.		Profana gradit...	Nepokretno k...			Nastala je uz ...
49	PALAČA ŠIŽGORIĆ	--	Zagrebačka ul...	Profana gradit...	Nepokretno k...			Sastoji se od ...
50	ROMANIČKA KUĆA	13. st. - 19. st.	Jurja Dalmati...	Profana gradit...	Nepokretno k...			Građena je na...
51	SAMOSTAN I CRKVA SV. DOMINIKA	20. st.	Obala palih o...	Sakralna građ...	nepokretno ku...			Crkva pseudo...
52	SAMOSTAN I CRKVA SV. LUCE	14. st. - 19. st.	Svete Luce 1	Sakralno - pr...	nepokretno ku...			Ženski benedi...
53	SAMOSTANSKA ZBIRKA SV. LUCE							
	SKLOP KUĆA U BUTI	15. st. - 18. st.	Ulica Buta	Profana gradit...	nepokretno ku...			Sklop kuća u

Figure 4. Extended attribute table of layer ‘objekti’

To publish our QGIS project to a web map the ‘QGIS2Web’ plugin was needed. With this plugin we were able to specify which layers and attributes and in which order to export, to give the attributes an alias, to define zoom levels of the map, to change initial visibility of layers, to make layer visibility switchable on the map, to add a measure tool, etc. The plugin enables other very important options for us – geolocation and location search. ‘Geolocate user’ option gives the map user the possibility to locate himself on the map. With the ‘layer search’ option a layer attribute table can be used for location search similar to a search engine on Google Maps. As a result, a *html* (HyperText Markup Language) file was exported. Additionally, we had to make some changes to the html code in order to get the final result. For example, pop-ups of object identification cards were initially visible only when hovering the mouse over objects on the map. So, we changed the lines of code for the pop-up function and made pop-ups visible only on mouse click. Another change in the code was size of the pop-up window. If a pop-up was too big the map centre would automatically move. Therefore, a scroll bar was added to the pop-ups.

RESULTS

In the final step we decided to embed the html file containing the web map inside another html file. This way a home page was created so users can get basic information about the project. In addition, a third web site was created containing identification cards of objects, so users can search through the database. The search is done by key word, i.e. if a user wants to search for a specific church he can type in 'church' and get listed all churches inside the database, or he can type in part of the name so only objects with this name appear in the list (Fig. 5). Last, the GIS viewer had to be published on a web server, so everyone can access it. Using an FTP (File Transfer Protocol) client all files were transferred and the web GIS viewer of cultural and historical sights in the old town centre of Šibenik can be accessed on the following web address: <https://gis-sibenik.000webhostapp.com/#karta> (Fig. 6).



Figure 5. Identifications cards search by key word

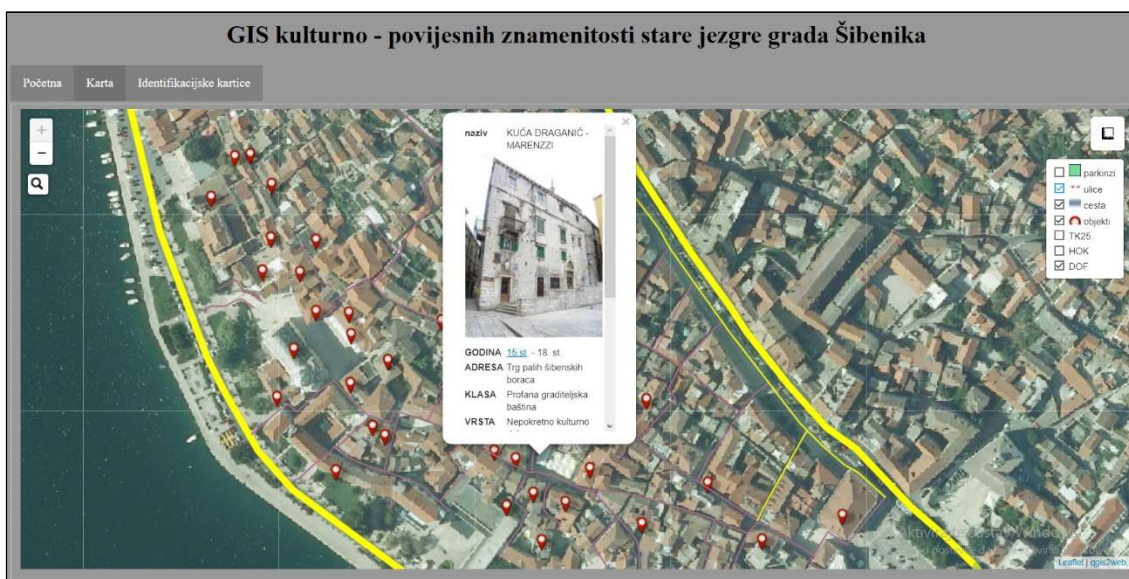


Figure 6. GIS viewer of cultural and historical sights in the old town centre of Šibenik

CONCLUSION

Tourism is playing a major role in the economy of most Dalmatian cities with Šibenik being no exception. The city is surrounded by natural beauty and it has two UNESCO world heritage sites but still no interactive map for tourist purposes. Within the old town city numerous buildings and tourist attractions are unjustly unattended. As a tourist, looking to explore the culture and history of a city, it is always pleasant to have more information about sights. A map plays a key role in this context. As cartographers we also have to provide information about cultural and historical sights in form of maps and other cartographic products. Given the necessity and the current state of geovisualization methods we decided to build a geographic information system (GIS) viewer on the web of the old town centre of Šibenik. Although the aim was to target mainly tourist we thought we would also provide investors and conservators with up to date information about buildings. When starting development, we had to consider the user profile, i.e. average web users and not cartographic professionals. For most of the objects data was either not available or possible to obtain, so an on-site research had to be conducted. By examining the buildings and with the help of 'Juraj Dalmatinac' Organization and the Conservation department we have gathered all the information needed to create an accurate database. For all sights inside the database an identification card was made. On the web site of the project it is possible to view and search the list of identification cards. Finally, using available software and services a lightweight, easy to use and interactive web map for tourist purposes was created.

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