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PRIMJENA WEB BAZIRANOG SISTEMA KROZ INTEGRACIJU WEB GIS ALATA I INFRASTRUKTURE PROSTORNIH PODATAKA U UPRAVLJANJU NEKRETNINAMA I NJIHOVOM MAPIRANJU

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Abstract:
Nekretnine su vrlo bitna grana ekonomije zbog vrlo značajnog uticaja u oblasti trgovine, prodaje i cijena u svim zemljama. Zbog nedostatka integrisanih i sveobuhvatnih informacija, najčešće ne postoji jasan i naučni trend za transakcije i metode određivanja cijena. Za ljude koji ucestvuju u industriji nekretnina ovaj nedostatak stvara mnoge probleme. Uvođenje i implementacija mapiranja, analize i upravljanja nekretninama je cilj ove studije zato što djelimično može biti rješenje za izražene probleme. Mnoge tehnologije i metode uključujući Infrastrukturu prostornih podataka (IPP), Web servise i Web GIS su korištene u ovom rješenju. Ove tehnologije i metode će se ukratko predstaviti i razmotriće se njihov odnos prema predmetu istraživanja i njihovoj ulozi i uticaju u rješavanju izraženih problema. Važnost mapiranja i analize nekretnina i njene lokacije kao jednog od najvažnijih faktora će se predstaviti kroz nekoliko primera, kao što je nekretnina imanja u Hadžićima, Sarajevo, BiH.
Keywords: nekretnine, mapiranje, IPP, Web bazirani sistem, Web Gis

THE APPLICATION OF THE WEB BASED SYSTEM BY INTEGRATING WEB GIS TOOLS AND THE SDI FOR THE REAL ESTATE MANAGEMENT AND MAPPING

Abstract:
Real estate is very important branch of the economy because of very significant impact on the area of trading, sales and pricing in all countries. There is a lack of integrated and comprehensive information and because of that many transactions and pricing methods most commonly don't have a clear and scientific trend. For the people who participate in the real estate industry this deficiency creates many problems. Introducing and implementing of the real estate mapping, analysis and managing is the goal of this study because it can be partially solution for the expressed problems. Many technologies and methods including Spatial Data Infrastructures (SDIs), Web services and Web GIS were used in this solution. These technologies and methods will be briefly introduced as well as their relation to the subject of research and the role and impact of them in solving expressed problems. The importance of mapping and analysis   real estates and its location as one of the most important factors will be represent through several examples, like as property in Hadzici, Sarajevo, BIH.
Keywords: real estate, mapping, SDI, Web based system, Web Gis

1. INTRODUCTION

Real estate is very important branch of the economy because of very significant impact on the area of trading, sales and pricing in all countries. Importance of real estate in many aspects, investments and profits that may be gained in this area, have created strong impuls for creating approach in this market for different individuals and groups. A few important factors play role in this field. Deficiency of awareness of some of the participants in real estate about the property information and the non-attendance of clear and comprehensive rules and regulations for the trading and pricing of property are some of those factors.[1] Property information is at this moment completely straggling in different organizations including property registration and cadastre office and municipality offices. There is a lack of integrated and comprehensive information and because of that many transactions and pricing methods most commonly don't have a clear and scientific trend. For the people who participate in the real estate industry this deficiency creates many problems. Those problems can be growth for prices without noting specific basis. [1]

1.1. REAL ESTATE INDUSTRY

Dhe real estate industry is very complex area. Decision making, planning, implementation and usage are some of attributes that make this industry very complexed. Many professionals such as engineers, lawyers, economist, environmentalists, surveyors are involved in resolvnig different tasks that make a real estate project successfully done. WEB GIS have many applications in the real estate industry. These applications enable real estate professionals and actors to measure the impact of location and this way make intent and judgement in many areas, including site selection, construction management, residential brokerage, appraisal, facility management and market analysis. [2] Real estate companies with the most successful understand that insight and timing are also a real value of the estate and not only location. GIS will help in spreading timeliness of information for both professionals and the other publicity. The improvement provided by GIS integration may help real estate development.

1.2. SPATIAL DATA INFRASTRUCTURE (SDI)

Spatial Data Infrastructures (SDIs) refer to a set of fundamental spatial technologies, policies and standards that improves access and utilization of spatial data. One of SDI tasks is helping to spatially empower groups and the states by providing the policies. [3] It has distinctly been revealed, especially in the last ten years that spatial data requirements of today's applications or projects could be met only through an effective cooperation between different institutions or parties. One of these applications is real estate. By implementation an SDI for real estate we can access large amount of spatial data. This goal can be achieved through interoperability cooperation between different organizations associated with the property.

1.3. WEB GIS

Web GIS is a combination of web technology and Geographic Information Systems. [4] In effect it is a GIS system that uses web technologies to make data accessible to the public who has or has not any knowledge about GIS. Therefore the main objective of webGIS is informing people through interactive maps. The user interface is very simple and allows a easy navigation through the map. WebGIS projects can be create using

basic functions, e.g. zoom in and out, or by area, search for place names, and switch on and off the layers. Alternatively, a webGIS can be a bit more complex and allow the users to access the attribute table of the layer by clicking on a feature on the map, editing layers, or filtering the data. [5].

The simplest architecture of a Web GIS requires one server, with a web application, and one client that is a desktop application or web browser application that allows the user to communicate with the server. Web GIS is a model, or architectural approach, for implementing a modern GIS. It's powered by web services that deliver data and capabilities, and connect components.

Web GIS can be implemented in the cloud (using ArcGIS Online), on-premises (using ArcGIS Server), or more typically as a hybrid combination, leveraging the best of both worlds. Web GIS isn't new. It's been evolving for a long while. Innovation in GIS have made Web GIS both possible and essential.

Web GIS provides many possibility, to provide wider access to your authoritative GIS data. This enable you to move your system of inscription to a system of engagement that has everything from self-service mapping to making better decisions. It makes GIS more accessible, affordable, and pervasive.

The shift from client/server architectures to Web services enables us to connect to a world of information, from our enterprise to the Internet of Things (IoT), Big Data, and more. This way GIS going forward into real-time mode instead of being static data. Users are more agile by using Web GIS, moving from custom application development to configurable templates and web app applications. Web GIS moves us from proprietary data into open data and shared services. That aplication of web gis can empower everyone.

Web GIS system is based on the following five components:
- User Interface
- Web Server and software server
- Map Server
- Data Server
- Database

Real estate management can be much more easy by ensuring a better way of collecting, accessing, using and managing spatial data. Web-based GIS with a SDI as a framework can be a very useful tool for facilitating property management because of the need for interaction between buyers, sellers, real estate transactions agencies, decision makers and planners.

2. THE LEVELS OF THE PROPOSED REAL ESTATE WEB BASED SYSTEM

Proposed real estate web based system in this article is composed of few levels: users, server, service, data and model. The structure creates an integrated and centralized real estate web based system that provides users: buyers, sellers, real estate agencies to find, sumarize, analyze, compare and research a real estate datas and its locatons, and also provides a search by criteria or a factor or to search for the region and its characteristics by economical, demografical, geographical or some other aspects. [1] The information is with descriptive terms such as registration and also in spatial form. [2] At the end, all the gathered and found information has provided user to make or to display on the map.

2.1. USER LEVEL

User level includes system users and components of the interface. Users system consist of several groups. Those groups are buyers, sellers, real estate agencies, government, academics and researchers. Those parts of system are used by target. [1]Users apply the system and share their information with different objectives. There are restrictions in this context. For example sharing spatial information by real estate agencies is a very controversial issue. These limitations can be overcome. The user interface consists of Web pages, including map pages, query pages, data entry pages and display of information. In order to increase the efficiency and quality of the system the plug-ins available including Google Earth plug-in, Google Map plug-ins used in the system. To increase capabilities of map to appropriate spatially display to user Openlayers framework is used for writing desired applications in JavaScript.

User can find the desired property using many methods on the map: find property by approximate address, by GPS coordinates, by searching on the map page. Data sum includes all types of data that are collected from multiple sources and assembled in the form of an integrated database.This database is made up of several different databases. (database for real estate management and marketing , spatial database that includes spatial data of educational places, shopping locations, streets, health centres, religious centres, industrial and workshop centres with their attribute information). These databases can be in relation to each other and can be integrated into a common database for real estate management. The spatial database from public places and streets is also used in practise. Consciousness of the both, quality and quantity of the access to public places (educational and religious buildings, shopping centres and health centres, government places and also the name of the various streets) can have an effective and great role in real estate industry (pricing and transactions).

2.2. SERVICE LEVEL

Modern Geographic Information Systems (GIS) technology is an integrated system of computer software and data and information about the location and geography of places. GIS is used to interact with, manage and display geographic information. A Geographic Information Systems is a system that allows to analyzing, viewing, understanding, questioning, interpreting and visualizing data in so many ways that reveal relationships, samples and trends in the form of maps, globes, reports and charts and other data presentations. [2]. Recent innovations carried out in GIS technology will have a deep effect on real estate and related industries. The importance of the''location''in the real estate industry have long valued by real estate practitioners. A few practitioners have considered GIS as the tool for locational analysis and considering GIS as a visual medium. GIS can help potential buyers to target and find quickly the right house, browse listings, view at an appropriate map, and choose an real estate agent from the home computer. GIS technology will increase the productivity of existing industry operations. Also GIS lead to greater exactness of information and access to information that previously was cost prohibitive or simply unavailable.[6] These advances will provide a greater range of information and real estate decision can be made by these advances. This will benefit consumers by leading to decisions that more closely address their needs

and preferences.. However, the need for professionals with advanced technology skills, including GIS, will grow by the time [2].

2.3 MODEL LEVEL

Users can find the target property by many methods and ways on the map that are:
- Finding property by typing approximate address
- Finding property by entering GPS coordinates
- Finding property by searching on the map page

Then usesr can go to display information page by clicking in the middle of property. This page more commonly consists of two parts. The selected property information is displayed in the first part that includes information collected from organizational services (SDI) and information entered. In this article the model of interactive map has been made by Geoserver and Web Gis Tools, Arc Gis Online and the Story Map application.

3. WEB BASED REAL ESTATE SYSTEM IN PRACTICE

In this article is represented the application of the web based system using an integrated web GIS tools and the available spatial data infrastructure (SDI) on the subject real estate property, in Hadzici Municipality, Sarajevo city in Bosnia and Herzegovina (BIH). It is considered its context, location, analysis, as well as research by different criteria important for all in the real estate industry chain (buyers, sellers, real estate agencies and all interessted users). Interactive web maps of real estate locations are published, and they are at the same time maps for searching real estate properties and its location by queries and requests for specific real estate and its datas and informations. Also it is possible to find a similar real estate properties in its surrounding by using this systems. The subject real estate property is published using Geoserver, an open source software, and web Gis components, using a shape files and KML files. In this article it is considered analysis of spefic datas of the Spatial Data Infrastructure, based on important and the key factors for the real estate property. The integration of overviews of the spatial datas and informations about specific spatial datas has been done, what certainly means interoperability of the systems and the kind of BIM methodology.

3.1. GEOSERVER

GeoServer is an open source software server written in Java that allows users to share and edit geospatial data. It is designed for interoperability, it publishes data from any major spatial data source using open standards. [7] GeoServer is developed, tested, and supported by a diverse group of individuals and organizations from all around the world. GeoServer is the reference implementation of the Open Geospatial Consortium (OGC) Web Feature Service(WFS) and Web Coverage Service (WCS) standards, as well as a high performance certified compliant Web Map Service (WMS). GeoServer forms a core component of the Geospatial Web.
GeoServer was started in 2001 by The Open Planning Project (TOPP), a non-profit technology incubator wich is based in New York. A suite of tools was creating by TOPP to enable open democracy and to help make government more transparent. The first of these was GeoServer, which came out of a recognition that a suite of tools to enable

citizen involvement in government and urban planning would be greatly enhanced by the ability to share spatial data. A Geospatial Web was envisioned by the GeoServer founders, analogous to the World Wide Web. With the World Wide Web, it is possible to search for and download text. With the Geospatial Web, it can be possible to search for and download spatial data. Data providers would be able to publish their data straight to this web, and users could directly access it (indirect and cumbersome methods of sharing data that exist today).

Those involved with GeoServer founded the GeoTools project, an open source GIS Java toolkit. Through GeoTools, support for shapefiles, Oracle databases, ArcSDE integration, and much more was added. Around the same time as GeoServer was founded, The OpenGIS Consortium (now the Open Geospatial Consortium) was working on the Web Feature Service standard. It specifies a protocol to make spatial data directly available on the web, using GML (Geographic Markup Language), an interoperable data format. A Web Map Service was also created. Also a protocol for creating and displaying map images created from spatial data. Refractions Research created PostGIS, a free and open spatial database, which enabled GeoServer to connect to a free database. Also, MetaCarta originally created OpenLayers, an open source browser-based map viewing utility. Together, these tools have all enhanced the functionality of GeoServer. GeoServer can now read data from over a dozen spatial data sources and output to many different formats. Now in its second decade, GeoServer is continuing on its mission to make spatial data more accessible to all. [7]

3.1.1. Publishing a shape file in Geoserver

The figure 1 shows an published shape file. In the table of the Layer Preview by clicing on the Open Layer the published layer will be shown (as at the figure 2).
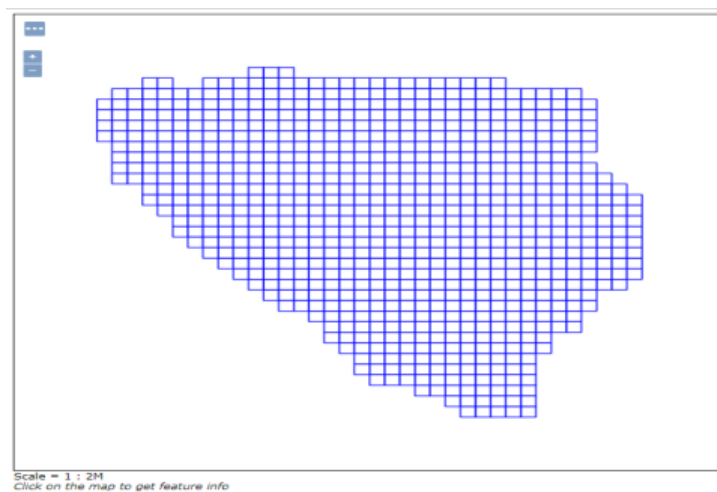
Figure 1. Shape file bih_ba_10km published in Geoserver

Fugure 2. Layer preview in Geoserver

By choosing a KML file of the published layer (bih_ba_10km) from the Layer Preview Table (shown in figure 2), a KML file of the mentioned shape will be downloaded. So, the published shape file could also be shown as a KML file in the Google Earth application.
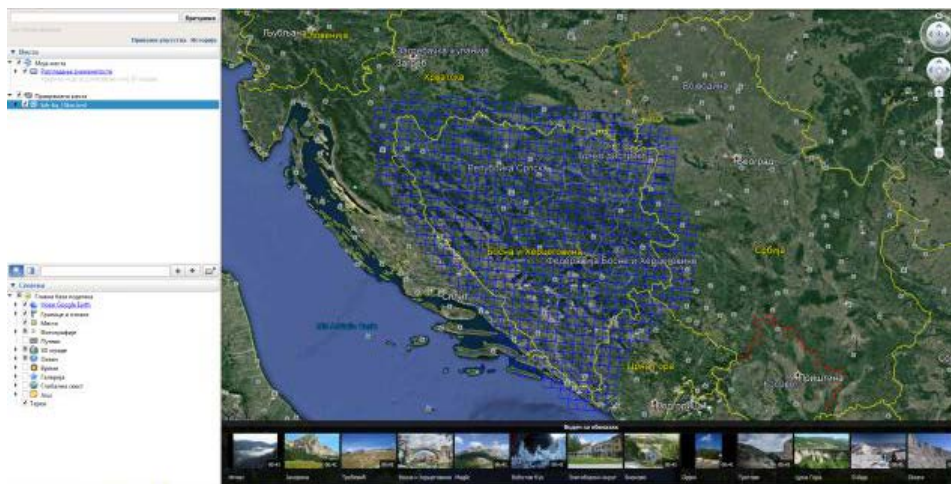

Figure 2. a KML file of the bih_ba_10km

The Google Earth application will be automatically open by clicking on the downloaded KML file. Here on the figure 2a it is shown a region of BIH with its division on the interactive 3D basemap. The subject real estate property is found by using a search options and it is visible on the preview. It is possible to label coordinate and location. By importing URL link of the property the visual connection is provided in order to better visualize (figure 3). It is also possible to add an URL of the imported picture of the

property that will apear after clicking in the middle of the property. On the Layer Preview in the Geoserver it is also possible to take a GML file.
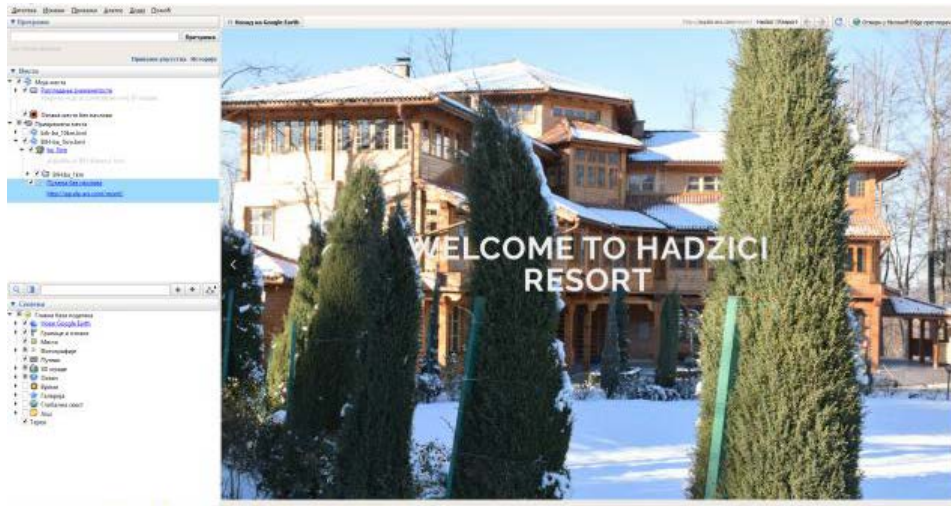

Figure 3. The linked URL page

In the Layer preview window of the Geoserver application there is also in the same row where the name of the published layer is a small window "select one". Choosing a shape file from the droping list it is automatically a zipped shape file being download. The shape file could be open in Q GIS softwer and there edited and again publish on the Geoserver for the external users (figure 4).
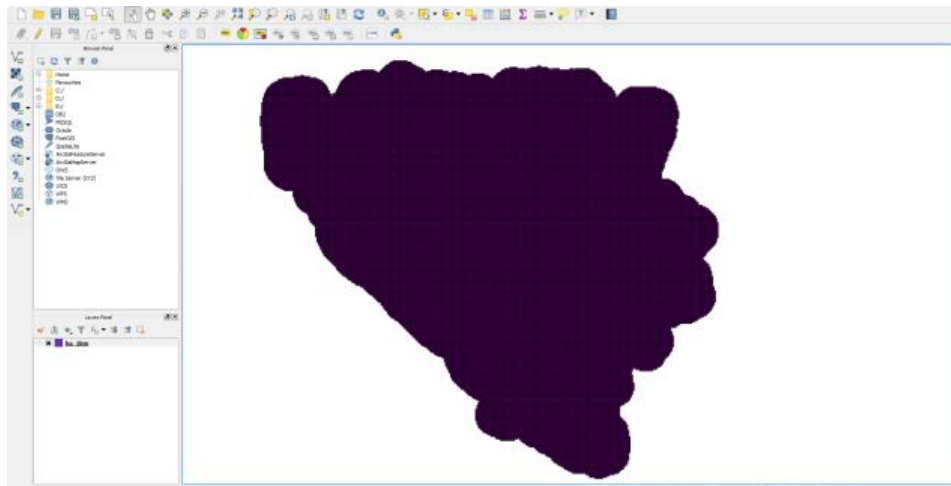
Figure 4. Shape file in QGis

Publishing a shape file with the landuse of the areas of the specific spatial units of the Bosnia and Hercegovina was the next step in this article.
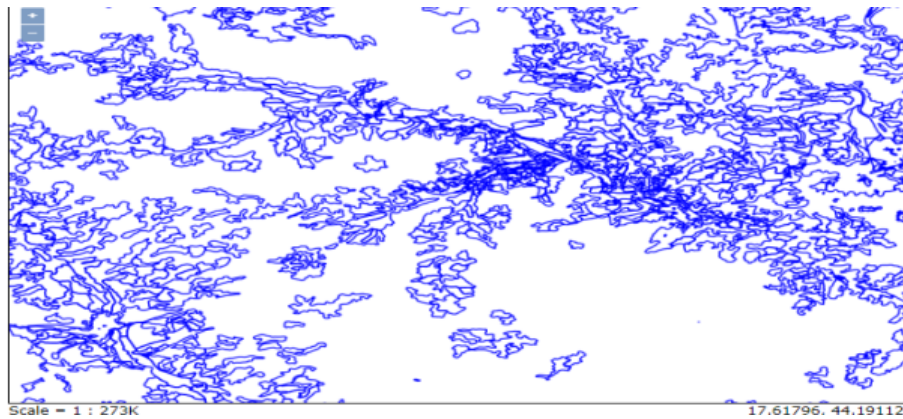

Figure 5. Published shape file of land use of spatial units in BIH

On the Layer preview window in the Geoserver the published layer of the landuse of the spatial units is shown. Choosing a KML fle from the Common Formats, the kml file will be automatically downloaded and open in Google Earth application.

The kml file will be opened in the Google Earth application as on the figure 6. Here it is posible to see what is the purpose of the land of the selected place, in this case a subject property, real estate in the Hadzici Municipality, Sarajevo,BIH. The subject place is marked and the shape file shows a purpose of the spatial unit_laduse. This maps could be saved in My places on the internet with a provided web address and could be use as a simple interactive map presentation and being helpful for the users, in this case one of the actors in the real estate industry chain.
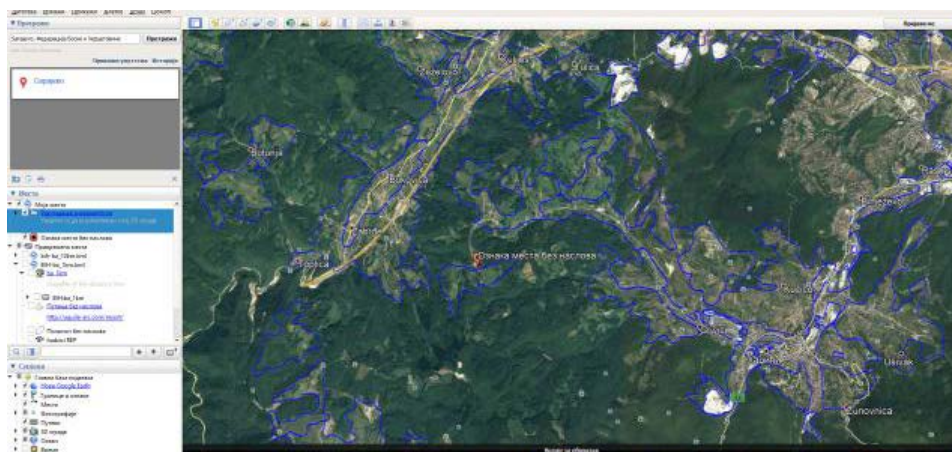

Figure 6. KML file of the land use of BIH imported in previous map

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3.2. ARC GIS ONLINE

Arc Gis Online provides both, map previewing and location analytics. It also provides an interactive mapping interface to help explore location and information about them. It is cloud-based platform wich provide the catalyst needed to share information inside and outside organizations. The file imported from the kml file in the Google Earth, shown on the figure 7, shows a datas in the table that are made in the Google Earth application. All imported datas are displayed on the table below the map preview. Also the map notes made in Google Earth application is present here.The map notes are styled by the purple dots on the map (the same as it was set in the Google Earth application), figure 7.

In Arc Gis Online import/ Addin layers/ files provides making alalysis and getting results. This results are very usefull in the Real Estate Property managing and creating a clear picture for the potential costumers, menagers and other factors in the real estate industry chain.
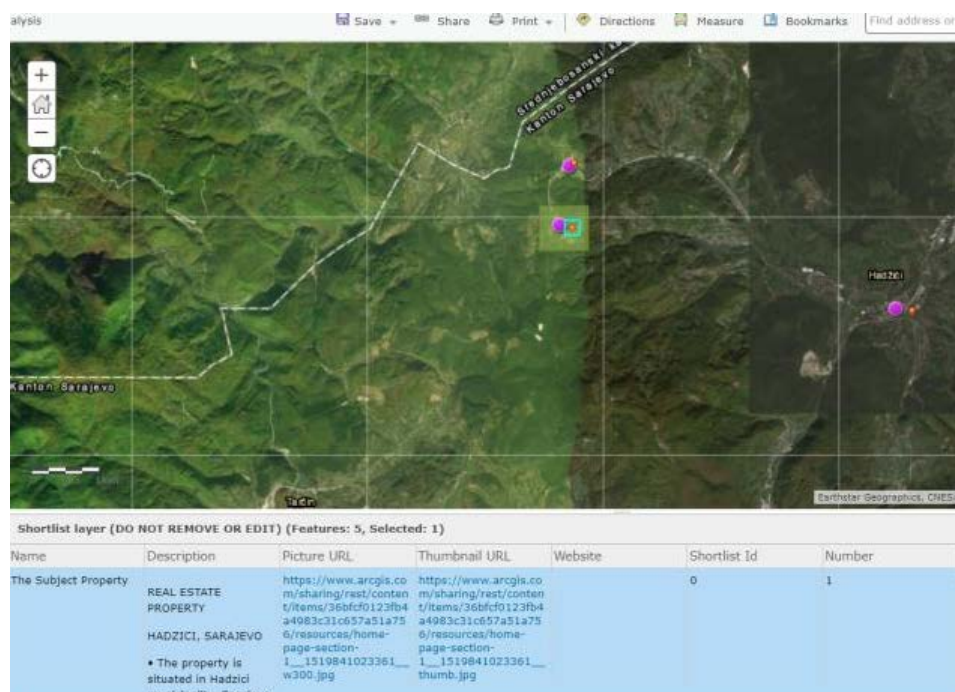

Figure 7. The zoomed area of the imported kml file

3.2.1. Importing a shape file in Arc Gis Online

In this map overview of the layer of the administration units of BIH has been imported. The shape file named BIH_adm consist of the next layers: BIH adm0, BIH adm1, BIH adm2, BIH adm3. Each of the layers represent a partition of the country BIH on smaller spatial units. The firsts partition refers on the division of the country into two entity-Federation of BIH and The Republic of Srpska. The second one refers to the division of the country into cantons, the third one into municipality and the null-layer is the shape of the state border of entire BIH. In the layer preview window it is provided accses to the

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layers, its characteristics, changing styles and getting the atribute table with a datas of layer. Clicking the „Show Table" icon appears the table with the all atribute of datas: ID, areas, the spatial division by state division criteria.

The combination of leyers and data is absolutely possible and provides many overview of teritory and the real estate property units in this case. For example, here can be use a cadastral datas and any other available government data, converted into compatible format and combine with the corresponding data unit, real estate property, to check the parcells, cadastral, municipality and any other governmaent spatial units wich is reffers to the real estate property that is considering like example in this work. All actors from the real estate industry chain could get the parcell border, its shape, area etc.

Adding a shape file in the Arc Gis Online makes an integrating process that consist of the visual overview on the map fileld with the aprropriate basemap and table datas overview. Blue line- selection of the municipality (Hadzici) -shows at the display and represent the boundary line of the Hadzici municipality-selection marker (figure 8).
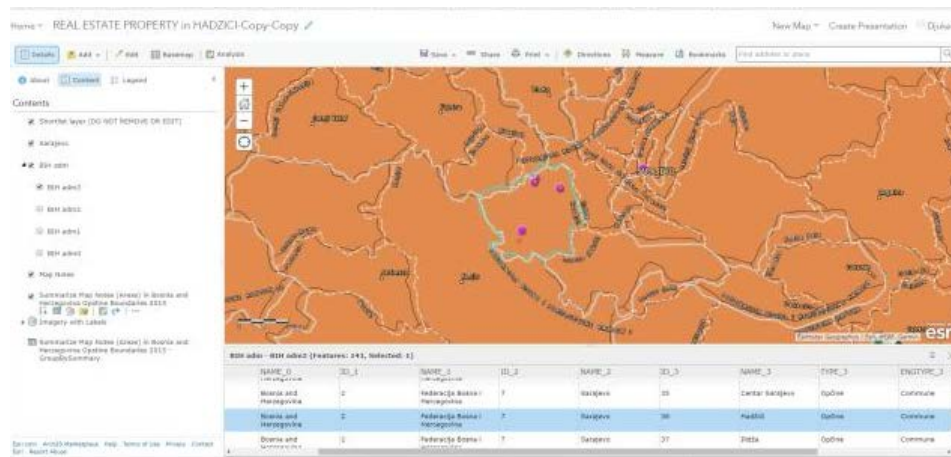

Figure 8. Importinga shape file of Administrative units of BIH

3.2.2. Analysis of the real estate data in Arc Gis Online

Location is a key factor in the success of real estate project. Most financial institutions offer value to their customers through the strategic location of their project. The location or the position of the real estate is one of the most important factors determining the value of the real estate. It is not only a geographical, but much rather an economic term, it is summing up for the totality of those environmental conditions and services that jointly influence the quality, comfort, use value and market value of the given real estate. Moreover, location is not just about finding any site but finding the best site [2]. The GIS technology can deliver the results what the investors need. By analyzing data connecting to locations, demographics, aerial photographs, traffic networks, shopping center usage, merchandise potential data, and competitive influences,the investors can find ideal locations for property. Web GIS helps the real estate industry analyze, report, map, and model the merits of one site or location over another. GIS can combine and integrate different types of information to help making better decisions and also give high quality visualization tools that can improve the understanding and enhance strategic planning.

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With the utilization of GIS web mapping services it is easy to create services and give information through internet which can be an indispensable tool in marketing. These services can show additional data like school districts, social amenities, shops, crime data, or transportation links [2]. Although the geographical location of a real estate property is always the same, its suitability and market value can change significantly over the time due to change in facility around it so analysis could help in understand the market value and trends in real estate industry.
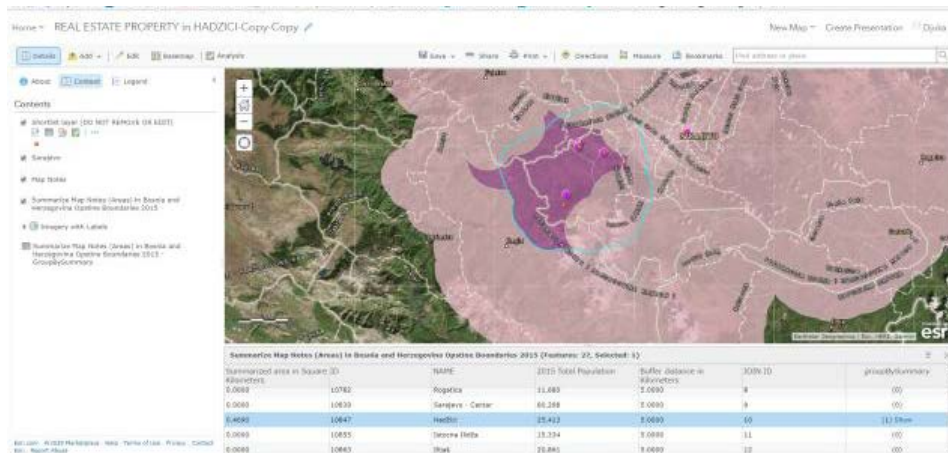
Figure 9. Analyse of searchig similar properties like subject property

Making Analysis operations choosing from the Arc Gis online Analysis list (Summarize Data, Find Locations, Data Enrichments, Analyze Patterns, Use Proximity, Manage Data) by giving apropriate queries and results from the analysis and its preview map will be displayed and available for users after publishing a map.

Feature layer generated from running the Summarize Nearby solution. Bosnia and Herzegovina Opstine Boundaries 2015 were summarized nearby Map Notes (Areas).

The query input was given by reasrching the simillar real estate properties like this one in Hadzici Municipality, Sarajevo BIH. The style of the map overview is given below on the figure 10.

Selected blue line shows the Hadzici municipality border (figure 10). The purple color shows the area with the simmilar properties, as it was requested in the query for searching that inside the Sarajevo region and its apropriated nearby location.

On the figure 11 is overview of the new analysis result shown. The Analysis operation that was used is Enriched Data servise. The query that was requested reffers to an total income in the BIH Municipality and city regions for the 2015 year. The target group or the target spatial area is area of the Sarajevo city to checking the economical environment,

what is in this case a very important fact for the Real .Estate Managing. The values is given in the data table, so the total income of the Sarajevo region is 2,874,895,239.27 BAM.
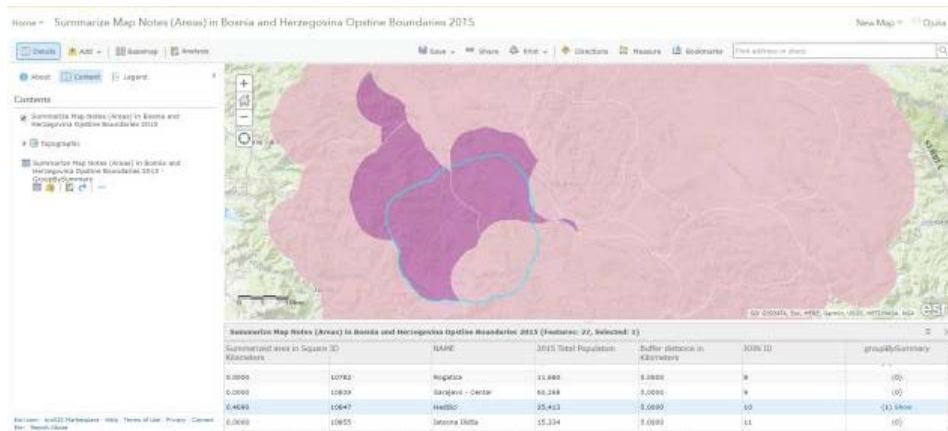
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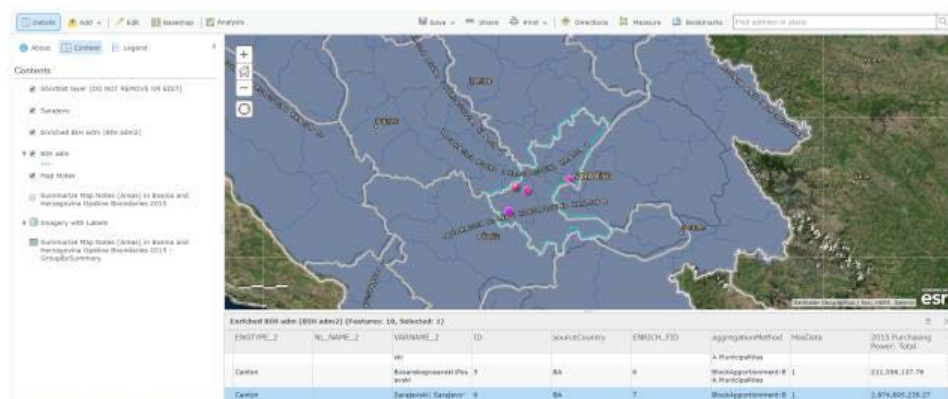*Figure 10. The border of Hadzici municipality*

Figure 11. Analyse of Total income of the BIH municipality 2015

3.2.3. Saving and publishing the real estate maps in Arc Gis Online

The map is published together with layers of the spatial units, map notes and analysis that was done in Arc Gis Online application. The Layers ofers a searching for the specific information or result that was given throug the layer- diferent format files, shape file in this case and the results of analysis query operation that was done (figure 12,13).
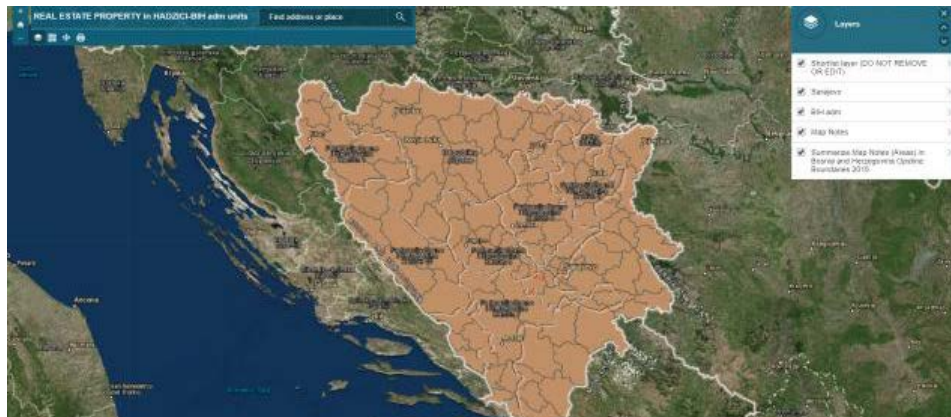
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Figure 12. Publish Arc GIS Online map with administrative units of BIH
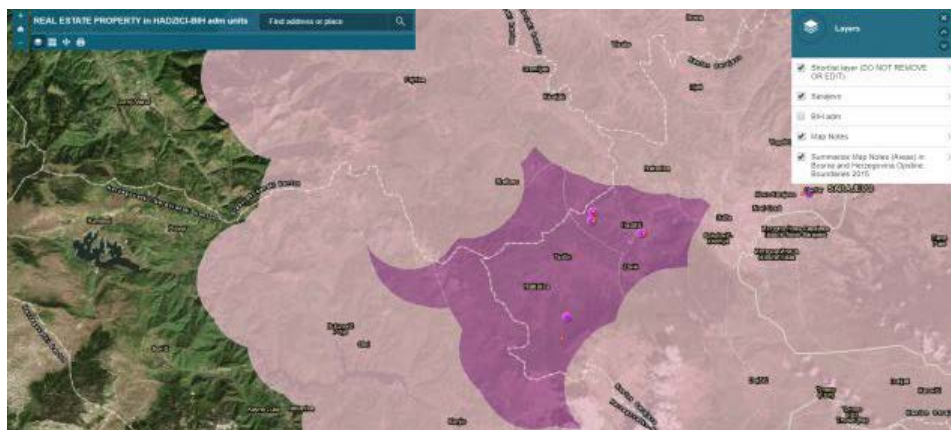

Figure 13. The results from the one of the analysis

3.2.4. The subject real estate property in Hadzici overviewed through the Story Map

The application of the Arc Gis that is used to make the overview of the subject property is Story Map Builder. Here is described a three parts of the property and locations as well. The map is good for better understanding of the property and its location. On the figure 14 is shown a part of the property in the particule tab (yelow color) with geolocations for the specified parts connected with images and textual datas. Figure 15 is display of the specific geolocation together with its datas, image and text. This software is choise of many real estate companies, such as The David Hicks Company, and they quotes this provides an interactive mapping interface to help explore locations and information about them.[9]
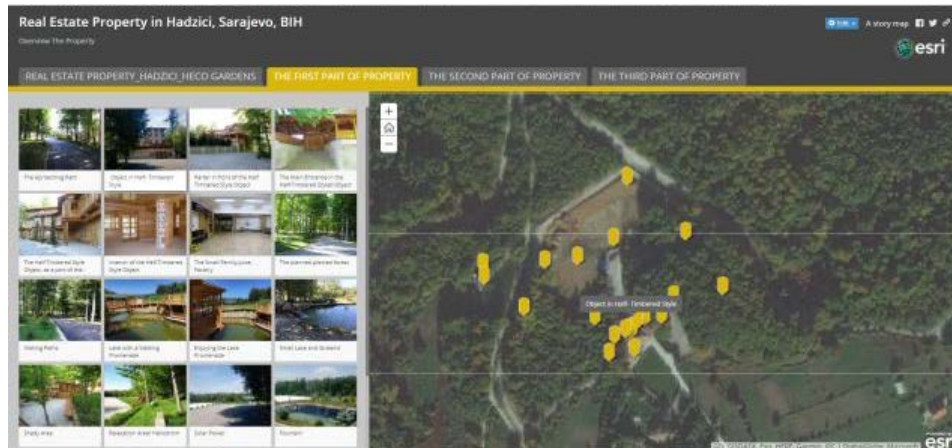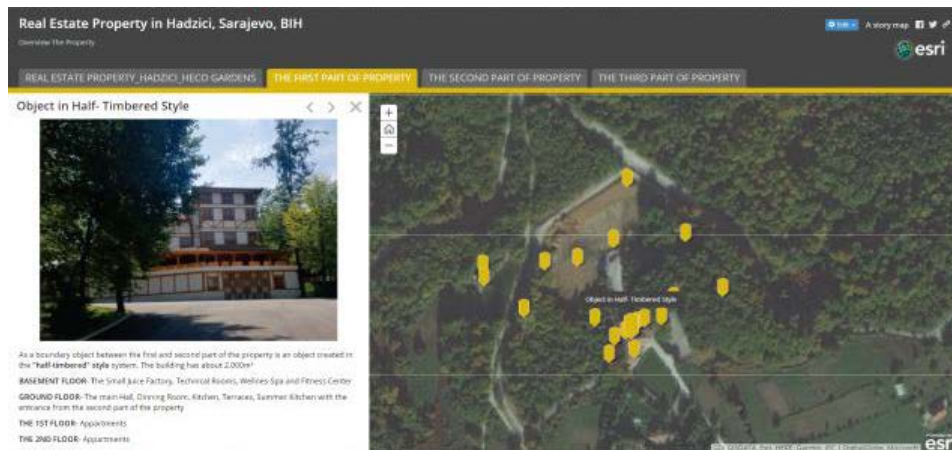
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Figure 14. Story map of the subject property

Figure 15. Story map of the subject property

4. CONCLUSION

The role of the web based system in this article, web GIS and Spatial Data Infrastructure (SDI) in collecting, retrieving, analyzing and sharing informations about real estate for usage by various users including buyers, sellers, real estate agencies was studied. Some of the applied technologies and infrastructures with some models used in recent years were applied. Implementation of the proposed real estate support system is a proper

method for various real estate users to easily access to all information about property that are assembled from different sources. Combination and modulation of web GIS and SDI with use of techniques like service composition provide a very large extent, of assertive information for various users. This information assists managing, advertising and making decision despite of distinctions and inconsistencies can be in formats and prearrangement methods and display information. Integrating this information and display it to the users prevents largely individual opinions interfering in real estate trading and pricing as well. The local utility values and the impact of that values on the trade and pricing indices get more logical process and clear direction.

5. LITERATURE

[1] J. Salajegheh, F. Hakimpour and A. Esmaeily. "Developing a Web-based system by integrating VGI and SDI for real estate management and marketing", in Proc. The International Archives of the Photogrametry, Remote Sensing and Spatial Information Sciences, The 1st International Conference on Geospatial Information Research, 2014, pp. 231-236

[2] A. Sharma and C.Rout. "Potential role of geographic information system in real estate inustry- an overview", in Proc. 2nd International Conference on Evolution in Science and Technology & Eyne on Educational Methodologies, 2013, pp. 321-325

[3] A. Rajabifard. "A spatial data infrastructure for a spatially enabled govern-ment and society" in A multi-view framework to assess Spatial Data Infrastructures, 1st ed., Ed. Melbourne: Space for Geo-Information (RGI), Wageningen University and Centre for SDIs and Land Administration, Department of Geomatics, The University of Melbourne, 2008, pp. 11-22.

[4] D. Blockley. "Web Gis." Internet: www.south-atlantic-research.org/webgis/introduction-to-webgis, Feb. 15, 2015

[5] N. Alameh, (2003, Oct.). "Chaining geographic information Web services". IEEE InternetComputing. [Online]. 7(5), pp. 22-29. Available: www.researchgate.net/publication/Chaining_geographic_information_Web_servi ces

[6] S. Deogawanka. "Spatial Law and Geospatial Technologies", gislounge.com/spatial-law-and-geospatial-technologies, [Sep. 9, 2015]

[7] B. Esther. Utilizing Web-based GIS Applications for Spatial Analysis of Real Estate Appraisal Data. Denver: University of Denver, 2015, pp. 61.

[8] "Geoserver an open source server", geoserver.org/, Apr. 16, 2018

[9] K. Richardson. "Helping David Compete with Goliath", medium.com/@Esri/ helping-davi-compete-with-goliath, Jun. 15, 2015