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THE IMPACT OF WEB 3.0 TECHNOLOGIES ON TOURISM INFORMATION SYSTEMS

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Abstract:
Tourism is a dynamic industry in which online information plays a crucial role for the whole lifecycle of the journey. The evolution of the World Wide Web, from Web 1.0, through Web 2.0 to Web 3.0 generation continues, and significantly affects the way consumers obtain information. On the other hand, tourism information systems support organisation's business processes, and integrate supply chain systems with customer relationship management. Currently, there is a gap between the implemented systems and contemporary technologies thatn the new Web generation brings. This paper explores the impact of Web 3.0 technologies and services for tourism information systems.

Key words:
semantic web,
social networks,
intelligent systems,
geographic information systems,
information systems in tourism industry.

INTRODUCTION

According to the UNWTO data, 2013 saw a record of 1.087 milliontourist on world level, which represents growth of5% comparing to 2012 [1]. Demand for international tourism was strongest for destinations in Asia and the Pacific (+6%), Africa (+6%) and Europe (+5%) [1]. The leading sub-regions were South-East Asia (+10%), Central and Eastern Europe (+7%), Southern and Mediterranean Europe (+6%) and North Africa (+6%) [1].

During the 90s, the Internet was the main instrument of tourism marketing, because it enabled marketers to create static online brochures [2]. Web 2.0 technologies, which emerged in 2005, such as social networks, blogs, podcasting, RSS, etc., enabled people who travel for tourism purposes to obtain information and interact with tourism service providers at any time, without paying high costs, and in different forms as well, from writing chats to audio-visual elements associated with tourism demand and supply [2].

Web 3.0 represents the next generation of the World Wide Web through the expansion of present Web 2.0, as well as a revolutionary trend, since it introduces transformational activities such as the increasing use of semantic technologies, expanded mobile services, location-based services, enhanced access to real-time information and a more ubiquitous and robust Web environment [3].

This paper will analyze the key elements of Web 3.0 technologies, and present their impact on tourism information systems.

APPLICATION OF THE SEMANTIC WEB ON TOURISM INFORMATION SYSTEMS

Semantic Web

Traditional Web search is mostly the keyword-based search, which usually is a long and hard work, because most of the time users separate the important from the unimportant. Following the rapid development of the Internet, the amount of information available online is increasing exponentially. The lack of standardization and common vocabulary still creates heterogeneity, which prevents easy search, information exchange and communication.

The next generation of Web technologies switches from a simple keyword-based search to the adoption of semantic technologies, in which search is conducted by context analysis and word meanings. The advantages of theSemantic Web are not only more accurate search results, but it also creates possibility of extracting information from various sources and their comparison, and allows performing of variety of services like e-commerce, e-health services and many more. What makes this possible is the accession of any resource to semantically rich information by description, i.e. each resource can be described with the information. For example, by adding meta data (data on data) about creation of some document, we can search documents that have meta data defining John Smith as an author of a specific document. With extra meta data we can also search for documents that are classified as scientific papers.

In the traditional web there were only URI documents (links to other documents), while in the Semantic Web those documents are associated with concepts, people and the relationships between them and the documents. For example, by adding unique identifiers to a person, role **author** and a concept **scientific paper** we clearly know who that person is, as well as other relationships between that person and the documents. The more we know about a person, the easier we can distinguish a large number of John Smiths.

The Semantic Web is a vision, or idea that information on the web defined and linked in such a way that they can be used by the computer, not just for show, but for automation, integration and reuse of information across a variety of applications [4].

Ontologies include semantic information and refer to various places [4]. They provide a unique, assertive and clear description. As the number of different ontologies increases, the task of maintaining and reorganizing ontologies in order to reuse them is a very demanding process. Advances in technology require ontological and methodological support and tools that enable an effective and efficient development. A key aspect in achieving this successful reuse of ontologies are Ontology Library Systems. They are important tools in the grouping and reorganizing ontology reuse and integration, maintenance, mapping and versioning.

Tourism information systems (TIS)

Depending on the business branch of tourism, different business information systems are used. Travel agencies in their operations mainly use reservation systems and information systems that support their internal operations. The hotel business uses systems like Property Management Systems (PMS), reservation systems and others. Tourist organizations use systems for managing tourist destinations (Destination Management System, DMS). Airline industry uses a specialized system designed to support their business processes and reservation systems.

Apart from a well-structured database, the characteristics of these systems are that they follow the traditional workflows, access to pre-selected sources on the Web and are often isolated from each other [5]. These systems can be accessed locally or in a Cloud Computing environment [6].

Modern information systems in tourism are often developed with service-oriented technologies in order to increase their flexibility in a changing business environment [7]. These systems are based on technologies for business process management (BPM), service-oriented architecture (SOA), Web services and XML open source technology [8].

Application of semantic web on tourism

The Semantic Web will allow information systems in tourism to easily access information on the Web, extract specific information, perform their transformation and store the data that will later be used for business or decision making. Framework of Semantic Web, includes major components, such as ontologies, ontology languages, tools, semantic comments, logical support, software agents and programs/services.

Ontologies provide the infrastructure to cope with heterogeneous representations of tourist destinations Web resources. The domain model ontologies may be taken as a single structure to provide information on the destination using the common representation and semantics. Ontology is a conceptualization of the programming domain from a human understandable in machine-readable form, and usually includes a class of entities, relationships between entities and the axioms that apply to entities that exist in this area. Through the use of meta data organized in a number of interrelated ontologies, the information about a tourist destination (for example, information about a hotel) can be labelled with their descriptions that facilitate retrieval, analysis and processing. The creation of a semantic network for a tourist destination requires [9]:

- Development of appropriate ontologies.
- Systems that create relationships and mutually map different ontologies.
- Systems that learn ontological connections through use.
- Development of working prototype semantic-oriented DMS.
- Inserting the semantics in the DMS service has the following advantages [9]:
- Semantically enriched DMS services handle interoperability at a technical level, i.e. they allow the DMS applications to "talk" to each other regardless of hardware and software platforms. This kind of interoperability can be solved with ontology mapping. It is a process in which two ontologies semantically relate at the conceptual level.
- Semantics can be used in the discovery and composition of the DMS Web services.

The main mechanism for detecting DMS services is the register of services and semantics can be used in the discovery of DMS Web services register.

In order to resolve the differences between the data stored on various web sites, we rely on the technique of semantic annotation introduced by Kiryakov in the 2004 [10]. Semantic annotation is a process of inserting the tags in the document in order to present the semantics of the text.

Semantic based DMS can be adaptable to users' needs: transport information, restaurants, accommodation, services, weather, events, itinerary, shopping, nightlife, day trips, rent- a-car, sports activities, etc. A prerequisite for this is that semantic metadata are attached to the components of tourist destination. DMS adaptation requires destination's offers (e.g. cultural event) from a database that is modelled using multiple descriptions (different patterns related to user requirements).

Knowledge discovery in database (KDD) with data mining is a useful tool for destination management [11]. The process of data mining is used for recording and ana-

lysing user preferences with respect to the components of a tourist destination. It allows precise targeting and personalization of the tourism product: the tools for effective destination marketing strategy. Semantic based DMS can generate user profiles based on the user preferences. The user profile is used for the expression of the characteristics and properties of the person. User profile consists of a static part (demographics such as name, gender, age, country of origin, etc.) and a dynamic part (interests, filters, traces). Filters describe a mechanism for expressing the interests of users. For example, a filtering system highlights the fact that the user is interested in museums. Traces describe the user's interaction with the DMS and a mechanism to record these actions.

The benefits of semantic-based TIS

Semantic-based DMS application allows consumers or travel agents to create, manage and update itineraries. Moreover, it allows the customer to determine a set of preferences for vacation and make a request for a set of information to find components such as plane tickets, rent-a-car and entertainment activities in real time. Semantic-based DMS provides full integration, flexibility, specialization and personalization.

Full integration: the semantic-based DMS can integrate both management and marketing into a variety of local tourism products and services.

Flexibility: semantic-based DMS can combine individual tourism products and services. They are an independent platform and can change their data without affecting their representation.

Specialization and personalization: precise targeting, personalization and privacy can be achieved through direct web marketing that is interactive, immediate and in accurate time. Through direct web marketing, tourism products and services can be personalized to the user's needs.

The use of semantic-based DMS provides better information management and achieves automatic intra-(or inter)-organizational communication of higher quality. The use of DMS enhances the destination picture and influences its promotion in the following fields [9]:

- **Tourist flow:** semantic-based DMS can increase visitors' traffic, attract the right market segment with accurate and updated comprehensive database.
- **Marketing**: tourism destinations will not be able to compete effectively, unless they promote themselves in the semantic network. Semantic-based DMS will increase a destination's presentation, enhance its image and attract direct bookings by providing specialized and personalized services. Market segmentation and targeting will be more effective and precise.
- **Management:** semantic-based DMS can create effective internal and external network, which can have the long-term positive effects on the local economy towards achieving competitive advantage.

INTELLIGENT SYSTEMS

Intelligence is the ability to understand, accept and retain knowledge and to quickly and effectively respond to the new situation [12]. There are two components of intelligence that usually stand out when the distinction between intelligent systems and those that are not [13]: the ability to sense the environment and the ability to learn from actions to maximize success in achieving certain goals. That way the intelligent systems interact with their environment and continuously evaluate the answers they receive from the environment in relation to their actions in order to determine their suitability. Intelligent systems perceive, reason, learn and act [14].

Intelligent systems must have the model domain in which they work, so that they can understand the inputs from the environment and generate an appropriate response [15]. They also must be able to set goals and vision of the future state of the field they work in so they could determine the impact of their actions. The main problems, on the technical side, related to the design of intelligent systems, include knowledge representation and reasoning, machine learning and natural language perception and facial recognition.

Intelligent sysitems in tourism

Tourism is the main domain of intelligent systems application, primarily because of the complexity of decisions to be made. This complexity, among other things, comes from the large movement of tourists, increased risk and uncertainty in unknown locations, the information retained in the distribution sources, idiosyncratic quality of decision making in tourism, multiple nature of tourism experiences and interaction between the decision [13]. So, intelligent systems can be of great help if they gather and process information according to personal and immediate needs of the user. The European Commission has identified intelligent systems as an important tool to support the complex tourism value chain, but also to "address the objectives of the expectations of the population and socio-culturally diverse customers (mass market) with unpredictable behaviour" [15, p. 6].

Earlier approaches to intelligent systems in tourism are mainly focused towards expert systems to support tourism enterprises and organizations [16]. Today, intelligent systems in tourism are mainly designed as a fully autonomous passenger advisers, or concierges who have the ability to set user preferences and assume their needs, and at the same time have large and specialized knowledge and continually evaluate their features based on the feedback they receive from the users [17]. Intelligent systems in tourism have been developed to provide services traditionally delivered by tour operators and travel guides, such as travel planning, navigation, interpretation, etc. [18]. There are several different examples of intelligent systems, like YourTour application that uses sophisticated algorithms as a function of the dynamic packaging of trav-

el arrangements. Application for mobile devices - Urban Spoon is a contextual system that integrates restaurant reviews for the purpose of making recommendations to users, and provides a fun interactive process allowing the user to receive recommendations by shaking the phone, instead of pressing a button. [13].

According to Staab and Wethner, intelligent systems must be heterogeneous, distributed, open and cooperative, completely autonomous, and support the complete tourist flow and all business phases [19]. To be able to function as mentioned, systems need to understand the supported processes.

Geographic information systems

With the development of digital maps, opportunities were created to link maps with databases which store data on the objects and their attributes. This way obtaining information became faster, complete and efficient. All this has led to the development of technology known as **Geographic Information Systems** (GIS).

GIS is difficult to define because it encompasses a number of areas. In general, the derived definition could be as follows: "Geographic Information System is an organized collection of computer hardware, software, data, personnel and network for efficient collection, storage, updating, manipulation, analysis, modelling, transmission and display of all forms of spatial information" [20, p. 11].

The importance of GIS lies in its ability to link activities which are spatially associated, and to integrate spatial and other types of information within a single system, thus providing a consistent framework for space analysis. Due to these characteristics, in recent decades GIS has become an indispensable tool for urban and resource planning and their management. Its ability to store, analyse, model and map large areas with large amounts of spatial data has found wide application. Today, GIS is used in land use planning, infrastructure planning, ecosystem modelling, transport planning, market analysis, real estate market analysis, etc.

GIS is also used within data and information sharing field. The process of extracting knowledge from information refers to the area called data mining. GIS represents an information system for collecting, packaging, testing, analysing, modelling and displaying reference information related to the Earth. In order to display that information it is necessary to have a relational database.

GIS has contributed to the change in the geographical orientation, which passed from descriptive and informative to problem solving. That is why the importance of this tool in the decision making process and geographic problems solving in the real environment is constantly emphasized.

The most important segment of GIS is geographic information. It implies the existence of space, time and attribute components. Each of these components can be changed, which determines the manner and choice of analysis, storage and information presentation.

Application of GIS in tourism

Tourism is a sector of the economy in which GIS also finds its purpose. Tourism today increasingly expresses requirements for the use of new technologies in tourist activities management and control, as well as in the decision making process. Initially, only few basic functions for the tourists were developed: hotel choice, information on the shopping centres near hotels or interesting tourist attractions. However, with the development of the tourism industry, GIS soon found its use not only in the choice of location, but also in the distribution, marketing and tourist traffic analysis. Today, within the field of tourism, this tool is mostly used in tourism planning, and tourism resources management.

Application of GIS in tourism involves many different processes [21]:

- Collection, manipulation and storage of information related to the area in which inventory of tourists and recreational resources is conducted,
- Condition testing via digital interactive maps, in the process of identifying the most suitable locations for the tourism industry development,
- Integration of databases in the analysis of trends and the intensity of the consequences of tourism activities in the area;
- Itineraries establishment and movements of tourists,
- Spatial analysis of the connections and relationships that exist between the various tourist and recreational resources,
- Physical modelling of the potential impacts of tourism to the area of study.

GIS is now also used to determine suitable areas for the development of ecotourism (GIS is used for mapping of tourist and recreational resources), the areas in which man's influence is the highest, and the areas that can still be called "natural."

The use of modern applicative geography tool in tourism, provides answers to many questions and problems of the modern tourist activity development [21]:

- If the local government cannot make strategic decisions due to the lack of information regarding tourism and recreational resources in a particular area, GIS allows the stakeholders to be informed and to learn in a systematic manner all the available resources and possible directions of development;
- In case of inability to determine directions for sustainable development of tourism in a particular area - GIS is used for monitoring and control of tourist activities once the developmental levels acceptable to all stakeholders are set. By crossing data related to tourism, ecology, economy and socio cultural aspects, GIS provides the ability to observe all indicators of sustainable tourism development, as well as their changes;
- The inability to manage and control tourist activities can also be solved with GIS because it makes it possible to identify areas suitable for tourism devel-

opment, as well as the areas of conflict related to the purpose and the use of space;

◆ Lack of understanding of the consequences tourism has on the environment which are permanent and irreparable - GIS allows modelling of the impact of tourism activities in the designated area at a certain stage of development (through network analysis, gravity models);

◆ Lack of understanding of the tourism dynamics (tourism affects the environment, but the elements of the environment also affect tourism) – in this case GIS allows the integration of socio-economic and environmental data, for GIS plays a crucial role in integrated and strategic spatial planning in tourism;

◆ Inability to connect the appropriate level of development, control and management – GIS has the function of decision-making support system.

However, the use of GIS in tourism planning has not yet reached a satisfactory level. The collaboration among geographers dealing with spatial planning, local government representatives and the public sector is still quite poor. Thus, the use of any modern tools such as GIS in management, planning and strategic decision-making becomes limited and negligible. The first step in incorporating GIS into the tourism industry can be the introduction of GIS to the universities that conduct tourism and hospitality courses. On the one hand, the economic effects of tourism activity are indisputable, but on the other, its impacts on ecosystems and the environment can be devastating. Therefore, it is imperative that all participants in tourism are familiar with both sides of the coin, so they coud responsibly participate in tourism planning and decision making. GIS is the best tool that can be used in the process of getting acquainted with all aspects of tourism activity in a certain area.

Application of GIS in tourism destination marketing

Promotion of tourist destinations through web marketing is based on data collected from a number of market research and statistics. To promote successfully, tourist organization should make a web portal with a city map, public transport plan, tourist attractions and other interesting places, such as bars, restaurants etc.

The creation of such a platform requires a GIS server as the basis of an information system. The license for GIS systems that offer web interface is relatively expensive. Therefore, highly efficient OpenGIS alternatives are usually selected. A website, which is developed, is built around an interactive map of high resolution (integrated Google Maps). Each object on the map can be accessed by clicking on the object on the map or via the directory divided into categories.

Due to the increasing competition in the tourism market, as well as the growing use of promotion through web technology, a website that promotes a particular destination must be attractive to visitors in a way that makes them express desire to visit the destination.

Application of mobile GIS applications in tourism

Significant use of GIS refers to facilitating the mobility of tourists in transit and at tourist destinations. Mobile GIS applications generally provide the following [22, p. 193]:

◆ Display of streets with names, shorelines, green space and wetlands and the like,

◆ Navigation map – zooming, moving, remembering past navigations,

◆ The ability to display textual comments on a map,

◆ Determination of the current position of the user and the marking on a map,

◆ Display of public transport lines and optimal routes calculations from the current to the desired position,

◆ Interactive tutorials that provide information about tourist attractions,

◆ Visual search of the tourist offer, restaurants, hotels and the like, based on the entered criteria of location, type, category, etc.

Nie et al proposed the use of Tourist route planning and navigation system (TRPNS), which should help tourists to determine the travel route and to facilitate moving along a certain path. The above-mentioned authors have designed and applied TRPNS, using Location Based Services (LBS). With the help of LBS and a portable device (i.e., PDA or mobile phone), that is "aware" of its position, it is possible to constantly refresh information about new locations. This way, tourists can plan the whole day, taking into account the suggestions provided to them based on personal preferences [23].

The basis of this system is the architecture consisted of three key components [23]:

◆ Portable devices with GPS receiver and capability of communication via the internet (like mobile phones or PDA devices);

◆ Service centre which consists of many web services performing searching, planning and navigation functions on the server side;

◆ Data warehouse infrastructure, including both spatial data and non-spatial data.

Profile management collects and manages basic information (name, gender, age, income) and travel preferences information (favourite dishes, monthly income, travel expenditures, etc.). Its main function is to maintain the user profile, and its other features include: system register, login and logout, user data entry and update. More accurately entered by the tourist, the system's query analysis functions return the result more realistic.

Query is the most important service within this system. It is offered by the Place of interest Queryweb service, and is run on mobile phones or tablets. Queries can be simple or complex. Simple queries are, for example, search for specific points of interests like cinemas, restaurants, beaches, museums etc.The search can be filtered by zone, price, restaurant type, and the like. As a result, maps containing large amounts of information are presented. In order to get personalized maps, tourists can use complex

search, conducted by using current location and users' preferences.

Route planning is offered by the route planning web services. A tourist issues a query, to which the web service, using complex programming logic and data base, responses by offering several routes that match user's preferences. Beside locations, this web service also plans efficient use of time. Based on several suggestions, which can be additionally modified by user, the final route plan is determined.

Navigation is also an important service within this system. Nowadays, the majority of tourism information systems provide a navigation function. Navigation system can efficiently lead tourists from one point to another. Through this system, tourists can plan their day with the series of activities recommended, based on their own preferences. Once the route and time used on each activity is determined, system helps the user to navigate thorough the route. In addition to navigation, the system provides the reminder function which can, for example, display the remaining time of stay at each of the points, so if the user exceeds the time, the alarm sets off. Also, the system can automatically change the schedule if a tourist for some reason cannot follow it (traffic jam, etc.).
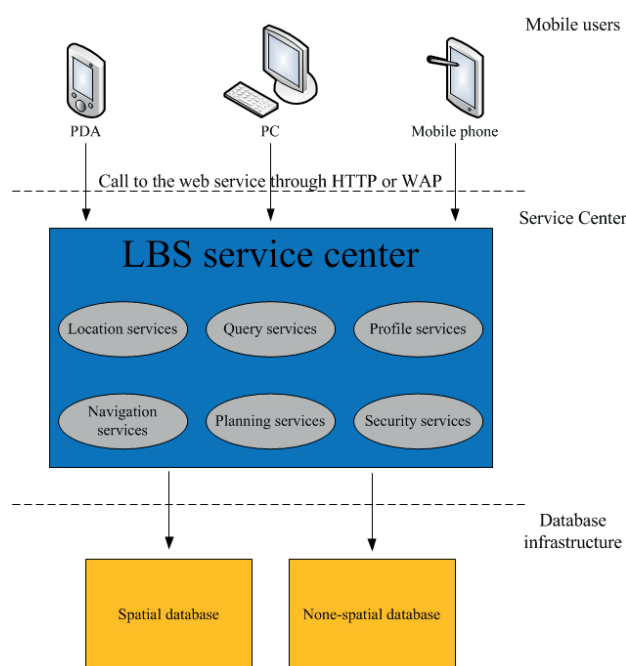

Figure1: TRPNS System Architecture[23]

CONCLUSION

Contemporary information technologies largely influence the development of tourism. The widespread use of mobile phones, tablets and PDAs allows visitors to stay informed of the latest travel deals at all times. Web services enable the new generation of visitors to access personalized offers based on their previous preferences, but also in the location where they currently are. Further development of the technology will only improve access to visitor services and products, but will also help the service providers to promote their products, as well as to create new ones based on those that visitors find the most interesting.

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UTICAJ WEB 3.0 TEHNOLOGIJA NA INFORMACIONE SISTEME U TURIZMU

Abstract:

Turizam je dinamična oblast u kojoj on-line informacije igraju ključnu ulogu tokom čitavog životnog ciklusa putovanja. Evolucija World Wide Weba, od Web 1.0, preko Web 2.0 do Web 3.0 generacije se nastavlja i znatno utiče na način nakoji potrošači dolaze do informacija. Sa druge strane, informacioni sistemi u turizmu podržavaju poslovne procese organizacije i integrišu sisteme lanaca snabdevanja i odnosa sa potrošačima. Trenutno postoji jaz između implementiranih sistema i savremenih tehnologija koje nova generacija Web-a donosi. U ovom radu se istražuje uticaj tehnologija i servisa Web 3.0 generacije na informacione sisteme u turizmu.

Key words:

semantički veb,
društvene mreže,
inteligentni sistemi,
geografski informacioni
sistemi,
informacioni sistemi u
turizmu.