RESEARCH TRENDS IN SEMANTIC BASED INTEGRATED TOURISM MANAGEMENT: A SURVEY

M.Thangaraj, K.S.Gomathi
1Department of Computer science, Madurai Kamaraj University, Madurai, Tamil Nadu, India
2Department, Madurai Kamaraj University, Madurai, Tamil Nadu, India

thangarajmk@yahoo.com, gomathi.kb@gmail.com

ABSTRACT:

The growth in the use of internet has transferred the web users to use the internet to gather travel related information. Although the information is plenty, it is difficult to get accurate and specific information. In order to solve these problems, the concept of semantic web comes into existence to have communication between human and computer. Travel and tourism are information intensive domains where in online information places a crucial role for the whole lifecycle of the journey. The backbone of semantic web is formed by ontology. Ontologies can assist organizational, browsing, parametric search and more intelligent access to online information. There are numerous applications operating towards semantic web and the fascinating among them is tourism that promotes the countries’ economy. This paper focuses on the survey that shows how semantic web along with Ontology help in providing right information and discusses various issues that are related to tourism management.

Keywords: Tourism, Semantic Web, Ontology, Personalized Recommendation Systems, Route Recommendation

[1] INTRODUCTION

Tourism has become the world’s largest business and has experienced consistent growth over the recent years. Tourism is viewed as data intensive business where data play a very important role for call and action creating. Because the web has modified people’s everyday life, it's considerably influenced by the manner of data gathering and exchanging within the space of Tourism. The World Tourism Organization (2006) predicted that, by 2020, tourist arrivals round
the world would increase over 200%. Currently, the internet is the primary supply of tourist destination data for tourists. Freshly the internet data resources increasing steadily, existing search engines cannot meet the requirements of users to realize high-quality network data resources. However, ancient search engines fail to fulfill their demands. There are two limitations of ancient search engines: First, if we input easy key words or question things, the system can match them and then output an over sized range of documents, among them, solely a couple of what users need are given as result . Second, the sorting of output results is mainly organized per some indexes of key words like it’s frequency, location, similarity yet as update-time. This sorting based mostly on keywords might not absolutely mirror the trend of users’ interest. So, we would like a competent methodology to resolve the issues of retrieving the documents mostly on the keywords within the document. To overcome these issues, the subtle technologies, like semantic web and ontologies are sensible candidates to enable the event of dynamic data systems. Ontology defines the terms used to gift a site of data that is shared by people, databases, and applications that specially, encodes information, probably spanning completely different domains yet as describes the relationships among them. This paper mainly concentrates Research On Integrated Tourism Management into four major Directions i) Ontology based System, ii) Recommender System, iii) E-Tourism and iv) Mobile Based System. Ontology Based System has been further classified into Ontology based recommender System and Ontology Based Personalized System. Recommender System has been further classified into four subcategories such as i) Route Recommender, ii) Travel Recommender, iii) Tourist recommender and iv) General Recommender. The Route Recommender System has been again further classified into General Route and Personalized Route System.

![Fig: 1 Research Directions of Integrated Tourism Management](image)

[2] **ONTOMETRY BASED SYSTEM**

Various Ontology based Recommender systems have been analyzed. The issues related to them and the future research directions are discussed in the following sections.
2. A. Ontology Based Intelligent System

A common perception is that there are two competing visions for the future evolution of the Web: the Semantic Web and Web 2.0. An interesting work illustrates how Semantic Web technologies can support information integration and make it easy to create semantic mash ups [26]. Through the ontology of tourism, the system allows the integration of heterogeneous online travel information. Based on Bayesian network technique method, the system recommends tourist attractions to a user by taking into account the travel behaviour of both of the user and of other users. In future, the system can be improved to provide the users the best results regarding their tour plan needs.

In the research paper, intelligent recommendation system based on Jeju travel ontology has been used. This system recommends the tourist, more intelligent information using properties, relationships of travel ontology [9]. Next, the system is responsible for finding personalized attractions and plotting location of traveller on the Al Map. And it provides not text based but visualization information with map. In the future works, it will be extended to real time reservation system for web service.

The ontology based System OIUTIS presents an Intelligent Ubiquitous Tourist Information [22]. It has a tourist domain ontology that consists of concepts for tourist contents and locations, and tour service application ontology for various intelligent tour services. OUITIS system consists of the TCS (Tourist content system), the BIS, the Tourist Information Service System (TIS) and the client system. The TCS contain Ontology and Database, and the Ontology is connected to the database by Semantic mapping. BIS /Traffic/E Map Service system provides real time information for traffic services. TIS provides tourist information to client systems with various graphic menu Interfaces, and also provides for Tourist’s preferred contents interactively by means of various bulletin boards. Thus, the improved intelligent ubiquitous tour service within the ontological approach has been implemented in the above system.

2. B. Ontology Based Recommender System

The recommendation system provides relevant documents to the users by identifying semantic relations between the ontologies that semantically represents the documents crawled by a web robot and user behaviour history [14]. Recommendation is mainly based on content-based similarity, semantic similarity and preference weights. The drawback of this system is recommendation of some wrong documents to few users due to the description of invalid concepts and lack of concept in the general ontology. As a future work, some knowledge and rules need to be defined that can be used to adopt semantic based inference schemes in order to define the topics and the relations in the ontology more clearly.

A system presents a multistage ontology-based touristic recommender system which offers: personalized suggestions to citizens and tourists, including those with special needs; and information concerning the suggested locations [3]. The system's suggestions are based on user profiles which are continuously updated via feedback obtained from past interactions. Users’ preferences are deducted by means of profiles and they are used to create and send queries to
heterogeneous information sources. The results are ranked and presented to the user along with related information. Since new context aware rules can be created and updated in each feedback process, the more feedback received, the more adapted the profile is concerning to the user necessities; furthermore, fewer changes will be performed in future feedback since all given preferences will be in rules first positions.

To serve the purpose of time and budget limitations, a new travel recommender system has been designed that evaluates the overwhelming number of POIs (Point of Interests) and provides personalized recommendations to users based on their preferences [5]. The recommendation process is performed in three steps including: ontology-based content analyzer, ontology-based profile learner, and ontology-based filtering component. User’s feedback adapts the user’s preferences using Spreading Activation (SA) strategy. Specific recommendations for future research directions includes considering contextual information such as the weather forecast, the season of the year, the time of the day, and the management of traffic accident. Furthermore, future studies can permit the user to add more explanations about the reasons that have motivated a certain recommendation, and use this knowledge in the recommendation process.

2.C. Ontology Based Personalized System

While discussing about the ontology based personalized system, there is a general design of architecture, based on software agents and oriented to the semantic Web, for the development and deployment of urban, ubiquitous services for citizens and tourist [8]. The goal has been set to create a platform able to provide personalized services based on recommendation algorithms, and users’ location, profile and preferences. In the current system, social features have not been added minding on personalized recommendation of the content. Hence, in future, the required things can be added to improve the human-computer interaction thus offering a new communication channel on the street.

A generic ontology-based architecture using a multi-criteria decision making technique to design a personalized route planning system has been suggested [19]. An ontology-based knowledge modelling technique using an analytic hierarchical process (AHP) has been used. The Tourist Relation Area Season Topic Model in this system helps to create a relationship among the data and degree of agreement generate a ranking method for the preferred areas. Collaborative tagging segregates the price and recommended places by using Nearest Neighbour approach. The N-way trustworthiness algorithm functions on the basis of joint probability distribution in the chain. Hence the user requirement is satisfied and the packages are created in the real time scenario.

In view of the defects of the traditional user modelling technology in personalized recommendation system, this research mainly studies the knowledge representation in tourism field and ontology-based model building method [13]. It also describes the implementation procedure of how to use the ontology editor tool Protégé to construct OntoTRec algorithm, and points out the procedure and method how to realize it. Recommendation tourism Model can help travel enterprise promote tourism products and improve tourists’ loyalty in the fierce competitive electronic commerce environment. Tourism ontology constructs in this paper is relatively simple,
further it will be improved in the future in order to further improve users’ satisfaction with tourism recommendation result.

[3] RECOMMENDER SYSTEMS

Different types of Recommender systems have been analyzed. The ideas and technologies related to them are described and the future research requirements are discussed in the forthcoming subsections.

3.A. Route Recommender

The route recommender has been further classified into two sub systems namely Personalized Route recommender and General Route recommender System which are discussed as follows.

3.B. Personalized Route

The proposed design provides a tourist support system for planning a personalized trip [23]. It includes a mathematical model which is adapted to the reality of the tourism sector. The system selects a series of activities for each day of the trip, ordered over the day, which are compatible with the tourist’s objectives and which meet all the constraints. A user friendly interface is developed which uses a series of forms to obtain the users’ preferences. Transport cost is not given much importance in the proposed system. It could be rectified in the future system.

The agent based system presents a novel recommendation system Turist@ which has been implemented via a specialized recommendation agent [6]. It incorporates the mixture of Content based and collaborative recommendation strategies and performs recommendation in heterogeneous scenarios. Agent based modular design permits to model different kinds of leisure activities in a flexible way and allows location aware front end in the mobile device of the user. Only two recommendation strategies are implemented in this system. Different types of recommendation strategies could be implemented in future research which cover many diverse situations ranging from new users to the users who have already enjoyed and ranked for past activities.

The personalized route recommendation system collects the Tourists Behaviours through a RFID and stores in a route database [25]. The proposed route recommendation system supplies the theme park tourists with the facilities they should visit and in which order. It satisfies the visitors’ requirements using previous tourist’s experiences. The present system does not consider the personal spending habits, diet favourites of tourists and does not include the information regarding number of entrances and exits in the theme park. In future Research, the proposed route recommendation can be enriched with factors such as personal spending habits, and diet favourites can be taken into consideration when generating the visiting sequence recommendation. Some theme parks might have multiple entrances and exits so that more complicated lay outs can be explored and studied.
3.C. General Route

The route recommendation system uses an algorithm that supplies movement routes with the location the user wants to visit [28]. The analysis is based on RFI and stored in a route data base. A simulation case is implemented to show the feasibility of the proposed algorithm. Visitor requirements are satisfied by the previous visitor’s preference. The definition of expectation support of interval considers the factors of interval and the corresponding probabilities. The recommended routes are based on RFID application and particle filtering technology.

The novel recommendation system sets its focus on the online recommendation system of travel routes by analyzing its current inadequacies [17]. In an integrated application of geographic information system, data mining plus personalized recommendation technology and the Web GIS technology, a novel personalized smart system was designed and implemented based on feature data of both users and attractions. This research paper has been concluded by providing the featured recommending service on smart tourist routes. The optimization of the algorithm is a subject of further research, the proposed recommendation methodology is largely dependent on the collection and analysis of users’ data on the personal characteristics with the network, leaving a room to be improved. The message push service, available through the smart mobile terminals with users, may help find out users, and obtain their information.

In the route recommendation system, a framework of a personal route recommendation for sightseeing based on mathematical programming techniques to obtain the tourist’s utility function and the optimal route has been set [12]. In the case of route planning, travelling and sightseeing times are randomly changed dependent on current traffic and congestion conditions, and hence, Time-Expanded Network (TEN) to represent these traffic conditions in the underlying static network with each discrete time step is introduced. Also the network optimization problem is introduced to obtain the personal appropriate sightseeing route. In addition, in terms of efficiency to obtain the optimal sightseeing route, a greedy algorithm based on dynamic programming has been developed so that the tourist obtains the appropriate sightseeing route quickly. The proposed modeling includes previous useful route planning models and parameter setting approaches for the tourist’s satisfaction, and hence, the proposed framework will be more useful. As an important future work, it should be needed to gather real-world tourism data from smart phones and Web and to analyze the data appropriately using the above mentioned model.

The route planning system presents a TRS and considers a new tourist trip design problem (TTDP), taking into account the compactness of the trip [11]. To solve this problem, fireworks algorithm (FWA) is adopted. As a meta-heuristic method, FWA has been widely used in continuous problems, while TTDP is a discrete optimization problem with various constraints, the key difference between them lies in the definition of distance. In this paper, operators of the conventional FWA are redesigned to handle with TTDP. Experimental results demonstrate the effectiveness of the proposed FWA. In the future work, to testify the efficiency of the proposed discrete FWA, comparisons will be implemented with more evolutionary algorithm, such as GA, ACO, etc.
3.D. Travel Recommender

A new travel recommendation system, which aims to provide a unified solution to user demands, is proposed [15]. It is a hybrid system that combines Case-Based Reasoning with domain-specific ontology. A novel similarity function, OntProperty, has been proposed, for the complex attributes which are instances in the ontology; the new function computes the similarity between such attributes based on their ontology properties. The results allow the formulation of the following conclusions: (1) the proposed OntProperty similarity function returns more accurate results than the other functions (2) the greedy case selection algorithm provides an adequate strategy for increasing the diversity of the result set, while maintaining its relevance; (3) the best query relaxation method is the one which employs structure for empty partitions and hierarchy on the basis of frequency features; (4) the ranking algorithm yields a correct order.

A study of exploiting online travel information for personalized travel package recommendation is another interesting direction [16]. The characteristics of the existing travel packages have been analyzed and a tourist-area-season topic (TAST) model and a Bayesian network for travel package and tourist representation have been developed. Then, based on this topic model representation, a cocktail approach and TRAST model have been developed. Experimental results demonstrate that the TAST model can capture the unique characteristics of the travel packages, the cocktail approach can lead to better performances of travel package recommendation, and the TRAST model can be used as an effective assessment for travel group automatic formation. These encouraging results could lead to many future works.

The Tourist Relation Area Season Topic Model helps to create a relationship among the data and degree of agreement generates a ranking method for the preferred areas [4]. Collaborative tagging is one which segregates the price and recommended places by using Nearest Neighbour approach. The N-way trustworthiness algorithm functions on the basis of joint probability distribution in the chain. Hence the user requirement is satisfied and the packages are created in the real time scenario.

3.E. Tourist Recommender

A successful attempt at evolving web intelligence in the tourism scenario throughout two main areas: User Modelling and Recommender Systems (RS) [10]. The innovative nature of this project: (1) innovative UM; (2) on-the-fly user profile update; (3) hot start results quality; (4) behavioural-filtering introduction and (5) multi-technique and heterogeneous RS. Some new developments include the addition of morphological analysis in the text mining algorithm, effective use of demographic data, ontology evolution and the inclusion of more diverse forms of social and Web 2.0 technology.

The recommendation system proposes a list of attractions, which is better to satisfy tourist’s interests and the current situation in the location [24]. Also, the system provides the tourist with descriptions of interesting attraction extracted from different Internet sources ranked based on other tourists’ ratings. The above said recommendation system uses binary ratings (“Like” or
“Dislike”) for attraction images and descriptions. The study sees the possibility to use triple ratings (“Like”, “Dislike”, or “Irrelevant”), which would allow recommendation system to ignore images and descriptions that are irrelevant to the attraction.

3.F. General Recommender

This system is mainly designed for elderly people that allow selecting the travel plans according to user ability [7]. The use of this approach, with the Web service, gives elderly people and travel agencies an opportunity to find automatically an adapted travel plan by considering user profile or group profile. To evaluate and validate the approach, the diversified database of test has been chosen and the following points will be evaluated based on the correctness of aggregation strategy of user profile, i.e., the effect will be satisfied major people in the group, the correctness of recommended travels, i.e., the effect will be the select of adapted activities and then travels and the performance time of processing, i.e., the effect will be the shortest time of processing to answer a request.

The Collaborative filtering recommender system has been developed for hotel recommendation using reduction and prediction techniques [20]. To enhance the predictive accuracy, Gaussian Mixture model with Expectation Maximization Algorithm and Adaptive Neuro-Fuzzy Inference System (ANFIS) have been used. The Principal Component Analysis for Dimensionality reduction has also been used. In such methods, ANFIS models of items and users are updated offline. However in the system, data is dramatically updated and therefore incremental learning approaches are needed to consider for future ratings. Future study will focus on further improvement of Multi-Criteria CF recommendation accuracy for tourism domain by incorporating fuzzy-semantic techniques.

E – Tourism

The development of dynamic packaging applications in e-Tourism is the latest advancement in e-tourism [1]. It enables the users to build a customized route by assembling various components of their interest which will be helpful to control the cost of the package too. It permits the user to specify a set of his preferences for a vacation tour and dynamically creates the package according to user budget and his needs. The system can be further improved to provide the tour plan in some more cost effective manner.

This intelligent system has three algorithms on recommendation system which are based on historical data, cookies and time scheduling respectively [2]. It provides the real agenda of activities which not only shows the user preferences but also provides users, the whole schedule which includes how and when to perform activities. The accuracy of the Time scheduling recommendation system can be further improved.

The user model considers context information to provide more evidence to more accuracy personalized recommendation; especially highly context-sensitive, real time and dynamic tourism service [27]. The recommendation quality of the model in this paper is better than traditional collaborative filtering method to some extent. There still exist some drawbacks. Conditional
probability is only collected through questionnaire, the limitations mean untypical, but Bayesian network result is not influenced by the conditional probability to large extent. Future study should consider other methods like expert-interview. Modeling and analysis is accomplished theoretically but technical implementation can be studies in the future. Some more products other than attraction should also have been considered in the future.

[5] MOBILE BASED TOURISM
The objectives of the mobile based system are;

1) To identify the benefits of leveraging semantic web technologies on the frame work
2) To identify the techniques used to provide personalized activities recommendations based on the user preferences.
3) To identify the methods used to build user profile that contains user preferences.
4) To identify the key location-based component that needs to be integrated in the frame work.

The aim of this paper is to present a generic conceptual framework for personalized mobile location-based service (LBS) tourism apps leveraging semantic web technologies to enhance tourism experience. In order to better improve the interactivity and further enhancement of the frame work, providing filtered information relevant to the user preference and contextual parameters such as time and location provides an added value which would enhance the user experience [18].

Information overload is a big threat in tourism domain. The mobile recommendation system has POST_VIA360 designs which analyze all the information coming from the whole life cycle of the tourism [21]. Even the initial benefits are good, POST_VIA 360 design is dependent on data set provided by social media such as Face Book, Twitter, Instagram etc., which may contain sources of information which may be currently out of reach of system. The Possibilities of Artificial Recommendation system can be expanded to make the POST_VIA 360 design an independent from a given data set.

[6] CONCLUSION

Enormous volume of Research is going on in integrated tourism management area in various research directions. The main focus of this survey paper is mainly based on four directions such as Ontology Based System, Recommender System, Mobile Based system and e-Tourism. Various issues and solutions are analyzed and discussed in this vast area. Ontology based system uses various techniques and recommends the users various attractions, their locations. It also provides personalized suggestions to the citizens and tourists to design a route planning system. Ontology based recommendation tourism model promotes tourism products and improves tourists loyalty in this competitive e-commerce environment. Future studies can be carried out in this area (i) to provide best results to users to plan their tour (ii) system to be extended to real time reservation system for web service (iii) to permit users to add more explanation about the reason to motivate certain recommendations and (iv) to improve user satisfaction with tourism recommendation result.
Recommender system proposes route recommendation that provides unified solution to user demands. Travel Recommender system provides personalized travel package that is created in real time scenario. It also provides service to elderly people according to their necessities. In future, the Recommender system could be planned to further more satisfy the users, avoid irrelevant descriptions regarding attractions and time taken to process the user request could be reduced.

E-Tourism presents a customized route planning system according to user preferences and provides real time agenda of activities that gives whole schedule which includes how and when to perform activities. In future, the system could be further improved to increase accuracy of the time scheduling recommendation and some more products other than attraction could also be considered.

Mobile Based System provides a generic conceptual frame work for personalized mobile location based services and reduces the Information overload which is considered as a major threat. As the future work, the frame work would be further enhanced to provide filtered information relevant to the user preferences and provide added value which would enhance the user experience.

At present, Ontology based Recommender System gains its importance in various domains and opens a vast scope for research.

REFERENCES


