

Personalized and Community Decision Support in eTourism Intermediaries

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Abstract. The rapidly growing web technologies and electronic commerce applications have stimulated the need of personalized and group decision support functionalities in eTourism intermediary systems. The goal of this paper is to propose a functional framework and design process for building a web-based customer-oriented decision support system to facilitate personalized and community tourism services. Major decision support functions include personalized data and model management, information search and navigation, product/vendor evaluation and recommendation, do-it-yourself travel planning and design, community and collaboration management, auction and negotiation, as well as trip tracking and quality control. A system implementation approach as well as a system prototype will also be presented and discussed.

1 Introduction

The fast growth of web technologies and applications in recent years have driven both business and public sectors towards adopting innovative e-commerce (EC) and e-business (EB) models and processes. Innovative business models emerged in the EC/EB domain include e-shop, e-mall, e-auction, e-procurement, e-marketplace, e-communities, e-brokers, e-advertisers, e-trust, value chain integrator, and other commerce-support e-intermediaries [20,25]. Major identified EC characteristics include global markets, 24/7 operations, quick responses, competitive pricing, multimedia and hypermedia information, interactive search and navigation process, personalized and customized services, innovative products and services, push and pull marketing mechanisms, etc. Inevitably, the travel and tourism industries have also faced new challenges that pushed them to adopt more innovative Internet-based strategies and technologies [3,5,12,18,23]. Developing new forms of products, services, systems and processes is considered critical for all participants in the tourism supply chain to survive from severe market competition as well as to sustain competitiveness and profitability. Eventually, the growing EC/EB trends have stimulated the demands of more information-intensive and decision-support functions and services that incorporate personalized needs and preferences in all tourism-related searching, deciding, and booking processes. For example, Puhretmair et al. (2002) indicate an inevitable trend of tourism information systems to offer extended decision-making support in tourist travel planning [14]. Ricci et al. (2002) present a case-based reasoning (CBR) approach for a web-based intelligent travel recommender system to support users in travel-related information filtering and product bundling

[15]. Buhalis and Licata (2002) point out that eTourism is still in its infancy but will be one of the most rapidly expanding industries on-line. They expect future eTourism intermediaries to be capable of fulfilling customer expectations and providing comprehensive and coherent services [1]. Stamboulis and Skayannis (2003) report that there has been a trend to flexibilization of the tourist product by a form of customization [18]. Werthner and Ricci (2004) discuss how EC and Web may change the structure of travel and tourism industries and forge new ways to satisfy consumer needs. More customized and configured tourism-related products and services are expected from the tourism supply chain. They also expect to see tourists playing a more active role in specifying their services and using reverse auction sites, and intermediaries such as Internet travel sites providing new market functionalities that focus on personalized recommendation services for travelers [23]. Yu (2004) present a web-based consumer-oriented intelligent decision support system (CIDSS) for personalized e-services and indicate e-tourism as one of the potential application area. Major application-level functional modules comprised in the CIDSS framework include consumer and personalized management, navigation and search, evaluation and selection, planning and design, community and collaboration management, auction and negotiation, transactions and payments, quality and feedback control, as well as communications and information distributions. [26].

It can be seen that the trend to provide more customized and personalized tourism-related products and services as well as associated decision support functions is quite obvious. Nevertheless, the function and service framework as well as the design and implementation method to efficiently and effectively develop such a desired tourism decision support system have not been well illustrated and sufficiently discussed yet. In the research literature of the travel and tourism domain, the dominant research approach is empirical study that focuses on information and communication technology (ICT) adoption strategies, marketing analysis, business performance, and customer satisfaction [2,4,7,17,19,21,22,24]. As for research in the tourism information system area, most of previous works focused on management-support, destination-oriented, or transaction-based planning and operation functions [6,9,13,16]. Only few have addressed personalization and decision support issues in the e-tourism domain, besides, only partial solutions have been delivered [8,10,14,25]. The lack of comprehensive research efforts regarding the development of personalized and community decision support systems for e-tourism applications is significant. This situation leads to the absence of a clear guidance for the e-tourism industry to embrace innovative EC/EB and Web technologies, to meet customer needs and create business values. On the other hand, current travel and tourism related information systems and websites such as Travelocity, Expedia, Priceline, Trip, and ezTravel, etc mainly provide similar destination information services as well as online reservation and transaction services at similar quality levels. Destination oriented information include destination guides, photo galleries, tour maps, featured events and activities, package deals, traveler tips and advice. Online reservation and transaction services include flight booking, hotel reservation, and car rental etc. Although several web sites such as Amadeus and Abacus provide flight search and connection planning services, no extended personalized and group decision support services have been provided in current web based destination, reservation, and intermediary systems. As for European Commission's efforts on tourism service network, i.e. the FETISH

project (www.fetish.t-6.it), current functions focus on supporting travel agencies to access traveler requested services and to integrate them into a convenient service package. The direct and personalized B2C services won't be provided until the B2B functions are fully matured. Therefore, more in-depth research exploration on eTourism issues regarding function and service framework, as well as design and implementation processes of the personalized and community decision support system is strongly demanded.

This paper aims at proposing a necessary function and service framework as well as design and implementation methods for constructing a customer-oriented decision support system for eTourism intermediaries to facilitate the desired tourism related personalized and community decision services. The rest of this paper is organized as follows. The function and service framework is presented in section 2, followed by system design and implementation approaches, as well as an operational prototype in section 3. The final section contains a conclusion.

2 The Function and Service Framework

Adapting Yu's CIDSS framework [26] to specifically take into account the tourism-related personalized and community decision support requirements, the function and service framework proposed for e-tourism intermediaries consists of personalized data and model management, information search and navigation, product/vendor evaluation and recommendation, do-it-yourself (DIY) travel planning and design, community and collaboration management, auction and negotiation, as well as trip tracking and quality control as major functional components. Explanation of corresponding tourism-related decision services are provided below.

Personalized Data and Model Management Services: Services provide in this group allow customers to create and maintain their personal profiles including basic information and personalized travel preferences, as well as evaluation criteria for selecting tourism-related products, services, agents, and vendors. Also included are editing facilities for customers to create personalized travel web pages that equip with subject directories, bookmarks, annotations and notebooks to link and manage frequently accessed tourism resources.

Information Search and Navigation Services: These services provide customers with search and navigational mechanisms to retrieve and browse detailed tourism information such as destinations and events, airline schedules and fares, accommodations and transportations, group packaged tours, as well as relevant news, weathers, maps, travel agencies and tourism suppliers, etc. Customers can also pick and save destinations, attractions, and accommodations in a personal favorite list for future use during the DIY travel planning and design process.

Product/Vendor Evaluation and Recommendation Services: Using decision support services in this group, customers may first specify their needs and preferences by retrieving previously stored data from personal profiles or by directly inserting data through an input screen for a specific instance, and then activate the evaluation process using system default or personalized evaluation criteria. The results are system recommended tourism products and vendors such as package tours and travel agencies that closely match customers' needs and preferences.

Do-It-Yourself Travel Planning and Design Services: Customized and Personalized travel planning and tour design are main functions of this services group. Through interactive steps, customers can specify regions/countries and number of days at the first place, and then design personalized travel plans by picking, bundling, and sequencing chosen destinations, attractions, restaurants and hotels in daily basis.

Community and Collaboration Management Services: The basic community services allow customers to locate people of similar travel interests, to form special tourism interest groups, to set up tourism-related community forums and communication channels, and to share travel experiences and resources. Advanced service functions allow customers to present their personal travel plans to the community, to exchange ideas and collaboratively design alternative trip plans, to vote and select one with highest votes as commonly accepted group trip plans for implementation. Extended supporting services include recommendations of alternative trip plans based on collaborative filtering or CBR techniques.

Auction and Negotiation Services: This group of services provides a dynamic and competitive pricing environment for customers to hold better bargaining positions. The auction services allow customers to issue tourism requests with specified needs and preferences, and then launch reverse auction sessions that call for travel agents, tourism suppliers, and tour operators in the tourism supply chain to bid on the posted individual or group trip plans. The submitted bids are then evaluated according to pre-specified criteria; and those with satisfactory cost/benefit levels are selected as candidates for contract negotiation. The negotiation services allow customers to negotiate terms and contracts with chosen tourism operators.

Trip Tracking and Quality Control Services: This service group provides mechanisms via fixed and mobile devices for group trip members and their families, the travel agents and operators to track in-progress situations during the tour operating period, as well as to make necessary changes for controlling the quality of services.

The proposed e-tourism decision support system also provides transaction and payments services for allowing customers to actually book and issue payments to selected trip plans, or to simply purchase specific tourism products such as tickets or souvenirs. In addition, the communications and information distribution services provide most recent and relevant tourism information for customers' interests, as well as email, online chatting, FAQ, situation reporting channels, feedback and complaint handling functions via wired and/or wireless communication networks.

Through the use of these innovative decision services, customers such as travelers and tourists are able to perform the following personalized and community decision processes.

1. To create and maintain personalized travel objectives, preferences, web pages, and evaluation criteria.
2. To search and navigate tourism-related information such as destinations and accommodations, attractions and features, package tours and travel agencies, etc., as well as to create lists of favorite destinations and accommodations.
3. To activate the evaluation and selection procedure using pre-specified criteria for choosing tourism products and vendors to match their needs with specified satisfaction level.
4. To design personalized travel plans when no existing package tours pass the pre-specified satisfaction level.

5. To find and organize customers of similar interests to exchange ideas and collaboratively design and develop commonly accepted group trip plans.
6. To propose requests and initiate reverse-auction sessions for inviting tourism vendors and services providers to bid on proposed individual and/or group trip plans, as well as to evaluate and select those with best bids as candidates
7. To negotiate terms and contracts with chosen travel agencies and tour operators.
8. To track the progress and control qualities during the tour operations of the contracted trip plans.

Customers can also book selected trip plans and receive new and just-in-time information in pull and push styles. With decision services to this extent, all phases of customers' decision-making process related to tourism and travel matters can be fully supported, and personalization and customization concerns be successfully incorporated. Figure 1 illustrates the proposed framework for personalized and community eTourism decision support functions with backend systems and servers

3 System Design and Implementation

For efficiently and effectively constructing the personalized and community decision support system for e-tourism intermediaries, we use Object-Oriented (OO) modeling approach to represent tourism-related information, decisions, and knowledge in a uniform way. OO conceptual models of specific decision processes are created and integrated to illustrate classes and relationships of all participated market players, products, decision models and knowledge. For instance, in order to carry out the package tour evaluation and recommendation process, classes and relationships of customers, travel agencies, package tours, evaluation models and rules must be identified and presented. Information attributes of a package tour object include tour name, regions/countries, destinations, attractions, tour duration, tour booking price, departure date, tour features, daily trip schedules, and accommodations (with names and ranks), etc. There are reference relationships between package tours objects and

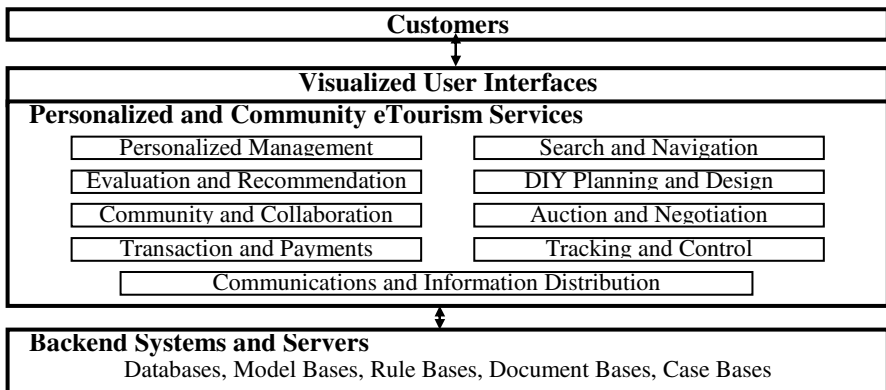


Fig. 1. The functional framework of personalized e-tourism services

customers as well as travel agencies respectively. The travel agencies provide many different package tours to the tourism market, while customers specify their specific needs of package tours for specific instances. A specific set of attributes in the package tour object can be chosen as measurement items of the evaluation model. When specifying their needs and preferences, customers provide values and weights of these measurement attributes as evaluation criteria. Retrieving data of these selected attributes from package tours provided by different travel agencies, and triggering specified tour evaluation rules, scores of every measurement items can be generated. Final matchability scores of these package tours can then be computed based on generated item scores and given weights. Package tours with final scores exceeding the customer specified satisfaction level are presented in a list for further inspection by customers. To be more specific, core objects identified for the package tour evaluation and recommendation decision process include Customer, Travel Agency, Package Tour, Destination, Attraction, Feature, Accommodation, Decision Process, Decision Model, Model Input, Model Output, Decision Knowledge, Knowledge Input, Knowledge Output, Customer Needs Instance, Instance Input, Instance Output, and so on. In this example, the selected instance input elements are Region/Country/Destination Name, Tour Duration, Tour Booking Price, Accommodation Rank, Departure Dates, Feature Names, and associated weights for each input element. Interval and multiple values are allowed for these input elements. The instance output elements include Tour Name, Region/Country, Tour Duration, Tour Booking Price, Accommodation Names and Ranks, Departure Dates, Tour Destinations and Attractions, Tour Features, Daily Trip Schedule, Travel Agency Name, Address, Telephone, Fax, E-mail, and Web Site, as well as the package tour's final Matchability Score. Decision Knowledge, in a simplified case, can be treated as a rule set. The decision process of the package tour evaluation case contains only one decision model and one associated rule set. All desired values of the model and knowledge input elements are obtained from input values of the instance input elements related to customer needs. Figure 2 depicts the OO model that conceptualizes the package tour evaluation and recommendation process; while

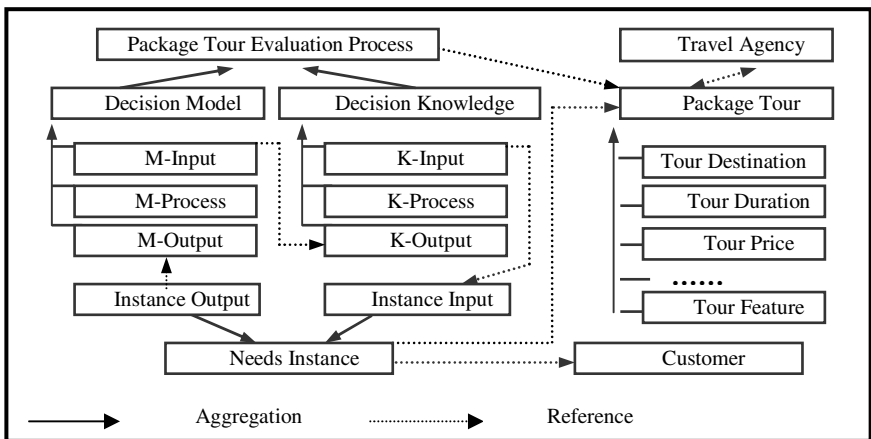


Fig. 2. An OO model for package tour evaluation and recommendation process

Figure 3 shows the evaluation model and associated rule sets. Conceptual modeling of the group trip plan auction and tour operator recommendation process can be conducted in a similar way. As objects of package tour, customer, and travel agency are changed to objects of group trip plan, community, and tour operator, and the attribute items, evaluation criteria and rules are slightly modified, a similar OO model for group trip plan auction and recommendation process can be developed. As for do-it-yourself travel planning and tour design process, the involved objects include Personal Travel Plan, Customer, Destination, Attraction, Feature, and accommodation, and the outcome is a daily schedule of the personalized travel plan. When submitting the personal travel plan to community for developing a group trip plan, or directly to auction session for selecting service providers, attribute values of the personalized travel plan such as plan name, destinations, attractions, features, duration, departure dates, expected price, accommodation rank, etc. must be specified.

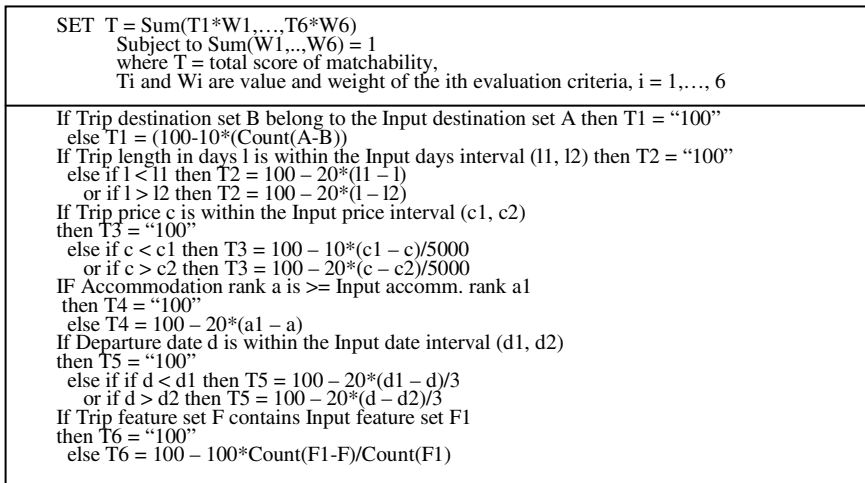


Fig. 3. The decision model and rules for package tour evaluation and selection

Eventually, package tours, personal travel plans, and group trip plans share many common attributes.

To facilitate system implementation and operation, we adopt a multi-tier Client-Broker-Server network structure that incorporates client browsers of customers, web resources servers of tourism suppliers, and application servers of intermediaries including information and recommender servers, community and communication servers, auction and negotiation servers, as well as backend database and document servers, model base servers, and knowledge base servers. The e-tourism decision support functions and services are placed in these intermediary application servers that link with backend resources, data, model, and knowledge servers. A prototype system is constructed using Dreamweaver web page authoring tool, Java scripting language, and SQL server database software. Application functions and interfaces, as well as the system embedded model and knowledge computation programs are written and executed as Java programs. The system required database is created and managed

using MS SQL server. Multimedia document files such as daily schedules, travel cases, and destination images are stored as separate files but still coded in and managed by the SQL server.

Figure 4 demonstrates several user view pages of the prototype system. Starting from the upper left hand side and continuing as clockwise, the first one is a guide tour page for destination navigation. The second page displays a package tour evaluation form for customers to specify needs and preferences, weights of measurement items and the acceptance level of matchability. The third page is an interactive working zone for designing personalized travel plan in which specific destinations, restaurants, and hotels can be selected and organized in daily bases. When the customer completes the design steps, he can review the final trip schedule in a separate frame and decide whether to stop or to make modifications. The final page shows a submission form for tour operators to place bids on specific trip plans listed in the auction page.

The service framework and prototype system have been proposed to a group of 14 CEOs and CIOs who take an EMBA class related to innovative e-services. And a survey regarding importance, feasibility, and potential effectiveness of the proposed services and system has been conducted after three weeks of focused discussions. The

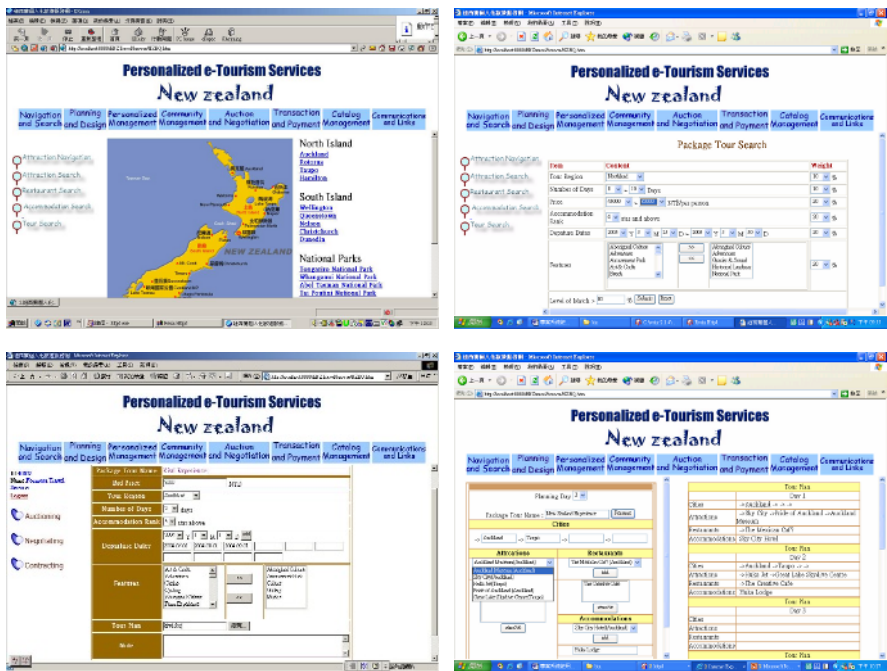


Fig. 4. A destination navigation page, a package tour evaluation page, a DIY travel planning page, and a bid submission page

survey outcome shows that both service functions and the decision support system are well received and highly demanded. Under a five-point scale measurement ranging from 1 to 5 as the very low to very high opinions for response selections, the average

scores of total importance and effectiveness are 4.5 and 4.4 respectively. The top three ranked e-tourism services are search and navigation (4.54), evaluation and recommendation (4.21), and DIY travel planning and design (4.21). Moreover, comparing the prototype system to existing tourism web sites, the prototype is trivially the only system capable of providing full personalized and community decision support services to customers in tourism domain.

4 Conclusion

In this paper, we first address the need of personalized decision support services in e-tourism systems, and then present a framework of personalized and community decision support functions and services. Major functional modules of the e-tourism intermediary service system include personalized data and model management, information search and navigation, product/vendor evaluation and recommendation, do-it-yourself travel planning and design, community and collaboration management, auction and negotiation, and trip tracking and quality control. Conceptual object-oriented models are created to represent the information retrieval as well as decision and knowledge computing processes. A system implementation approach is provided and an implemented prototype system is also presented to illustrate the system operation processes as well as to validate the effectiveness of the proposed personalized decision support functions and services. It can be expected that by using the system and services all e-tourism customers, intermediaries, and the entire supply chain can leverage their capabilities and create substantial values. Future research topics include practically implementing the proposed service framework, as well as measuring system performance from both the customer and business perspectives.

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