Intelligent Information Interactions for Tourism Destinations

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Abstract

This paper presents a model supporting intelligent interactions of tourists with other tourists and locals and the tourism information of a particular Destination before, during and after the trip. The approach tries to bridge the "Community Gap" which is the lack of interactions among tourists and between tourists and locals at a particular Destination. Community interactions are very important both for prospective visitors and for Destinations for many reasons including, greater independence and self-planning in the visit's design, exploitation of the local society knowledge about the Destination, as well as promotion of regional policies and collective purchases of services from prospective visitors. Modern information technology has become ubiquitous, supporting visitors with a variety of devices ranging from handy devices, to Community Walls, to paper interfaces, to home PCs. The paper focus in the description of the knowledge bases and their capabilities for intelligent interactions for supporting tourism communities at Destinations.

Keywords: visitor attraction; connected community; ubiquitous computing; knowledge support

1. Introduction

The proliferation of the Web over the last few years led companies and organizations to try to exploit the Web for e-commerce activities. Tourism is one of the most important applications of e-commerce. Several major tourism actors but also new comers (information technology companies mainly) have an established Web presence, visited by many thousands of visitors every day, offering e-commerce opportunities for business to business transactions or business to customer (tourist) transactions. One particular class of tourism applications in the Web is Destination Information Systems (DIS) or Destination Management Systems (DMS) (Christodoulakis et al., 1996; Christodoulakis et al., 1997; Evans and Peacock, 1999; Pan and Fesenmaier, 2000; Werthner and Klein, 1999). These systems typically provide in the Web, information about the tourism offerings of a given Destination and may promote e-commerce activities to the potential visitor. The existing DMS's however do not support advanced models of interaction between tourists (or prospective tourists) of a Destination, nor interaction between tourists and locals. It is the authors' belief that this is a serious limitation of the existing DMS's, and therefore

this paper proposes an expanded functionality that provides the tourists with intelligent interactions based on a virtual community concept of tourists and locals that has a common interest theme, “Tourism at Destination”. The implementation of this functionality may be in an independent system complementary to DMS’s or as an expanded functionality of existing DMS’s.

Information systems that support interactions of a virtual community over the Web, which has some specific interests (the glue of this community), are usually called Community based Information Systems (CIS). Existing CIS’s in the Web focus to foster social objectives like building community cohesion, enhancing community awareness in local decision making, developing economic opportunities in disadvantaged communities, and enhanced training (Schuler, 1994). Some of them have user populations of the order of tens of thousands who are repeatedly visiting the community site. However the support that the existing CIS’s offer is of general purpose and they cannot be easily used to offer advanced functionality for tourism related communities.

It is considered that it is very important both for tourists and for Destinations to support advanced information models enabling the interaction of tourists and locals for tourism related subjects. Such systems will bridge the “Community Gap”, which is the lack of interaction among tourists and locals at a particular Destination. Some of the advantages offered to both tourists and Destinations by these information models are detailed below.

First there is a reason of providing the visitor with evaluation information that is not given by a particular organization (which may be biased or may not recognize the real visitor preferences). In a CIS, community members like visitors, may leave evaluation information about a site of interest or a service organization (hotel, etc.). Such information may be more trustable to other visitors than recommendations given by a Destination Organization or a Travel Agent. Sometimes this provision of community evaluation is convenient even for Destination Management System Organizations, which may not want to offer their own evaluation (or recommendations) in order to avoid potential conflicts with partner organizations at Destinations. It may also be convenient for the Regional Administrations, which may be interested to have objective quality of service information delivered to visitors in order to increase competiveness of the tourism offerings at the Destination, but they do not want to be directly involved in such an evaluation.

For prospective visitors who have a desire for greater flexibility in planning their own trip, a contact with a tourism community for the Destination offers advantages of increased security in their planning which comes not only from the evaluations that other tourists have given about sites and offerings of the Destination, but also by the fact that they can get directly in contact with members of the community at Destination to ask specific questions. In fact, it is a great misconception of today’s information system builders that any information system, no matter how big its databases are, can satisfy all the potential visitor questions about the Destination offerings.

Another advantage that the community based information systems for tourism offer is the greater potential for repeat visits that they create. This is not only due to the

greater quality of information and better evaluation that they offer, but also because they offer increased opportunities for human connections between tourists and locals and the emotional attachment that they carry. Established contacts during the visit may also become trustable sources of information and evaluation creating further security for future visits. From the Region Management point of view virtual communities offer a great opportunity for the Region to promote Regional policies like branding. This can be done for example by promoting the creation of specific types of tourism sub-communities with specific interests. From the prospective tourists point of view, virtual communities also offer the opportunities for collective agreements of potential visitors with local or international companies. By opening a discussion forum for a visit at a specific time and with specific interests, a group of potential visitors may be found, which may be in a position to negotiate collectively better services and better rates from companies and organizations.

This paper describes the functionality needed for the provision of community based intelligent information interactions for tourism destinations. Section 2 presents the proposed approach, section 3 describes the Knowledge Base mechanism that elaborates the approach and in section 4 indicative supported services emerged by the Knowledge Base are introduced. Finally in section 5 a specific application based on this approach as well as its evaluation are outlined.

2. A new Approach to Promote Tourist Destinations

One goal of the approach is to develop an alternative, quality based tourism support system through the environmental and cultural characteristics of an area, the anthropocentric perspective and the various local communities, and to promote the concept "tourism=hospitality".

The approach may be viewed as a system diffused in the territory to facilitate and support the exchange of information between different communities in a local, physical environment (such as a destination, an area of interest, a visitor attraction) with the aim of building a dynamic shared knowledge accessed by tourists and locals.

It is based on an *interaction model* that maps digital information over physical spaces. The users can access the system through a variety of interfaces, both innovative and conventional (PC, web access, public kiosks, etc.). Examples of some of the most innovative interfaces are the outcomes of the research and development within the Campiello[1] project: paper-based interfaces (giving interactive access to the system through conventional paper, in various graphic and narrative formats), large public screens (allowing interactive access to the system by a group of persons) and mobile communication devices.

The system's *maintenance model* is based on the concept of reward: the more the users upload "valuable" information, the more the system gives access to "valuable" information. This model also supports a distinction between "public" information, that circulates freely within the system and becomes a public resource, and "private"

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information, that is circulated in the system but is only made available as a "travel diary" to some users. Both types of information contribute to the creation of a shared knowledge (information plus personal experiences) that is based on a combination of cold data (the basic functional information) and warm data (the description of the experience of the community of users).

The *information model* is mostly based on the concept of "push information": information is mostly circulated with the model of push media (edited information is proposed to users according to their profile and to their physical position) but the system stimulates the reaction of users in the form of annotation (comments, ratings and further contributions attached to the "core" piece of information). This annotated information is re-circulated within the system giving origin to an exponential growth (with over-annotated information also progressively moving from cold data to warm data).

The *social model* of the approach allows different roles to both users and professional editors: anybody can assume roles ranging from a "passive" use (simply retrieving information), to active "contributors" (information given and retrieved), up to "cultural managers" and "moderators" (available for the editing of the information, facilitators and managers of the shared knowledge).

The *spatial model* of the approach is strongly related to the notion of mapping digital information over material physical spaces and builds on this model various interaction models. However the system also takes full advantage of the potential of remote communication and participation: access to the shared knowledge is given also to remote users. Information is connected to the physical space via distributed interfaces to access content: Space is the main structure to navigate and interact and mobile and ubiquitous computing is augmented with personalization.

3. The Knowledge Base

The cornerstone of the approach is its Knowledge Base that efficiently supports a rich set of services and diverse interaction means. The Knowledge Base is based on a schema that captures the semantics of objects handled by the system. To enhance readability, this schema is described in five parts:

Items, *Contexts* and *Person* describe the basic modeling abstractions for the description of information items, users (people) and semantic frameworks (contexts). Destination/Region/sub-Region, Tourism attractions/sites of interest, service organizations, events, are indicative examples of tourism – related concepts modelled by Items. Contexts are used in order to group together items with common semantics or typology. For example a tourism attraction (e.g. Ancient Kydonia in Chania, Crete) can be associated to the context of Minoan Palace/City, Venetian Construction, and Venetian Church. Additionally the virtual community of the Archaeologists of Crete is also represented by a context. Visitors, locals and experts (e.g. archaeologists) are described by the concept of Person.

Traces describe the interaction of users with the system and the mechanisms for recording these actions. Evaluation information (e.g. ratings, comments left by visitors for a tourism attraction) is a specific type of traces.

Filters describe the mechanisms for expressing user interests. For example a filter expresses the fact that a visitor is interested for Archaeology and specifically for Minoan sites and for restaurants with traditional dishes nearby.
Descriptions are used to model the content of information items. A historical event (e.g. the Battle of Crete) may have several descriptions in various templates, associated with the living memories of locals or the official reports of organizations or the discussions of the virtual community of historians.
Map support refers to the associations between the information items and their spatial representation. The information for a tourism attraction (e.g. the Archaeological Museum Of Heraklion) is indexed on top of map(s) and accessed through it. Moreover the community of Archaeologists of Crete has also a representation on the map.

4. Supported Services

A number of services that exploit the Knowledge Base are described next. These are grouped into four categories, creating the content, accessing the content, support for user communities and indexing content on top of maps.

4.1 Content creation

Travel Diary: The diary is a tracing mechanism, essentially a sort of memory of user actions (places visited, topics discussed, recommendations and comments made, other persons met, personal notes) to guide user's future interaction with the system. To protect privacy the system gives only aggregated statistical data based on the evaluations of users found in their travel diaries and not the diaries themselves.
Topics of discussion: A topic of discussion is an abstract place where people “meet” each other with the objective to exchange information related to the discussion. Topics are hierarchically structured from more general to more specific ones, so that it is possible for a user to narrow the context of the discussion. A topic groups together information items and the discussions correspond to posting comments or recommendations visible from all its members.

4.2 Content access

User profile: The user profile is a way of expressing the characteristics and features of a Person. It consists of a static (demographic info such as name, sex, age, country of origin etc) and a dynamic part (interests, filters, traces). User profiles are a central issue in all system functions.
Searching: Searching refers to finding items and recommendations from other users. Searching also supports ranking in order to help the users decide more easily on the items that they are interested in.
Personalization of information: In the traditional collaborative filtering (Resnick and Varian, 1997; Resnick et al., 1997; Shardanand and Maes, 1995) the system finds a set of similar users ("friends"), based on the user ratings on common information items. The system utilizes the information about the friend's actions (e.g. the evaluations that they gave about information items) in order to suggest more

information items to the user. This approach has the so-called "cold start" problem, i.e. when there are no sufficient actions in the system by the "friends", the system cannot give reliable recommendations.
In the proposed approach personalization is supported via a combination of content based and collaborative filtering (Anestis, 2001). User profiles are compared to find groups of users with similar interests called friends. Friends may also be explicitly indicated by the user, or may be found not on the basis of matching the whole profile but only a part of the profile indicated by the user. In order to provide personalization for a specific user, the traces of his/her friends are examined and items with high ranks are suggested to her.
The collaborative filtering algorithm used is based on traces. A trace type may have a feedback, which expresses the degree of satisfaction or the interest of the user. The particular methodology gives a solution to the well-known "cold start" and "over-specialization" problems reported in traditional collaborative and content-based filtering literature (Babalanovic and Shoham, 1997; Pazzani, 1999).

4.3 Communities of people

Communities are groups of people having something in common. They are related to topics and physical places that are of interest to their members. Members of the same community may have access to information not seen by others. Examples of communities may be members of a family, a group of friends, archaeologists in Crete, hotel owners etc. Communities are used to establish and maintain links between people. Members of a community have a certain degree of trust between each other and this can be used for the collaboration filtering mechanisms mentioned above. It is possible to have a moderator for a community. He/she is a user (expert) with special privileges granted from the system. He is responsible for assuring the quality of information that flows into and out from the community.

4.4 Map support

The map services were designed in order to provide users with on-line maps, adaptive to user-defined criteria. These criteria apply to the information (Items) to be projected on the maps and may refer to the content itself -contexts, time etc.- or to spatial attributes. The interface also allows performing spatial queries and acquiring movement directions.

5. The Campiello Application and evaluation

During the i3 LTR Esprit Project Campiello (http://www.campiello.org, http://www.i3net.org) the above model and its implementation was followed by the partners of the project in order to develop applications and intelligent interfaces for a variety of devices that promotes the tourism product of the cities of Venice and Chania, Crete and facilitates the creation of connected communities and better connect the members of the communities (local inhabitants; past, present and future tourists; cultural managers) by local people or tourists.

Special care was taken so that Knowledge Base supports in a uniform manner diverse community interaction means with completely different characteristics regarding both the computational and the presentation capabilities. The partners of the project have investigated three new methods of communication between social teams and information repositories (Revised Campiello System, 2000). These are intelligent paper (IP), community wall (CW) and mobile-device (MD) interfaces. The Knowledge Base that was described in this paper may be accessed by users using either their regular home PCs/monitors, their MD or a CW. The user interaction models are different for each one of the above cases. Nevertheless Internet remains the linchpin allowing the access to the information model from anywhere using various user interfaces.

IP technology allows the programming of common paper with a specific behaviour by encoding non-visible information related to the actual content of the paper. Based on this a user may leave his trace on a paper and the system will recognize it and respond by presenting him the information that meets his personal interests. Two different types of applications have been implemented, personalized newspapers and travel guides. The former allows news presentation personalized according to the user preferences already known to the system. The user may then comment/rate for a topic and sees the comments/rates for this topic by other people of a community with the same interests. The later one creates personalized maps according to the user interests as well as his geographical location, allow a user to see how other visitors/locals evaluate the sites or the tourist services provided in the area and to leave his own comments/rates for these.

CW technology is based on the use of large interactive screens located in public places where people are gathered and communicate. The information presented is mainly related to warm data (news, comments, ratings, suggestions) provided by various communities, and is dynamically refreshed according to various rules such as the information inserted to the system by other sources, the interest shown or the rating of a specific topic, etc.

MD combined with GPS for identifying location; support the finding of paths of maximum interest to the user and also the presentation of multimedia information to a visitor while wandering in a city. Such information maybe the history of a building, events relevant to his profile, or even a nearby person that shares the same interests.

The provided environment is complemented by the PC user interface that integrates all the above functionality but also the traditional structuring of tourist “cold” information for the destination.

The system was thoroughly tested in a public, open experiment in order to evaluate the capability of the Campiello system to reach its own concept and objectives as well as to verify the usability of the various technologies of the system and interfaces developed during the project. The aims of the feedback collection and the evaluation were:

The acceptance of Campiello’s concept: The evaluation parameters that was set for the specific objective were: demographical in order to analyze the population participated in the experiment, profiling interests in order to analyze the acceptance of the various types of information provided by the system, tourist in order to investigate

the possibility -in the future- for Campiello to provide also tourist services, popular items (e.g. events, places) in order to locate the most interesting, for the visitors, activities of the local communities and finally "campiellized" parameters (i.e. contact with the locals, acceptance of Campiello, keeping relation with locals) in order to directly analyze the main ideas of Campiello.

The technology usability: The evaluation parameters that was set for the specific objective were usability, learnability, aesthetics, error prone and handling, reliability, stability, map usability, content creation.

The main evaluation methods that were adopted were the questionnaires and the logging of user actions when interacting with the Campiello system.

Questionnaires: For the purpose of the experiment two different types of questionnaires were produced. The first one aimed to the collection of feedback regarding the technology usability and the second one aimed to the collection of feedback regarding the acceptance of Campiello's concept. About 1000 questionnaires of the first type were distributed and the number of the filled questionnaires that were finally collected was about 300. More than 70% of the users evaluated the system for more than 10 minutes. 28% have only registered to the system and have visited only the introductory pages, the 33% have spent some more time browsing whereas the 39% have tested many of the services offered. More than 4000 questionnaires of the second type were distributed. The response was more than satisfactory, since the collected filled questionnaires were about 600, i.e. 15%. Based on the analysis carried out, more than the half of the visitors had contact with locals and it is also noticeable that almost 30% expressed their wish to keep in contact with the locals they met. The most interesting result is of course the wide acceptance of the Campiello concept and the willing of the visitors to use a system like Campiello in the future.

Logging user actions: This technique involved having the system automatically collect statistics and measurements about its use. The basic purpose of this mechanism was to record the users' actions in the system. User actions in the system were classified to various types. Each user action was recorded in a transparent way through the creation of a trace. The trace types, which have been defined, were the following: Rate, Comment, Visualize, Registration, Print, Read e-mail. In addition, the type of the interaction device (PC, Paper, CommunityWall) was recorded for each trace. In this way useful conclusions were extracted regarding the use of each interaction device. During the evaluation process about 5000 traces were recorded in the Knowledge Base. The number of registered users approached the 500 people.

6. Summary and Conclusions

A new approach for the promotion of tourism attractions was presented. The approach, starting from TIS functionality, attempts to bridge the "Community Gap" (i.e. the lack of any interaction between the content providers and the content consumers) and to provide support for the promotion of a visitor attraction. Our approach handles both typical tourism information about an attraction and warm

knowledge, related with the experiences of other visitors/locals associated with the attraction.

Its cornerstone is the Knowledge Base (KB) that efficiently supports a rich set of services and diverse interaction means. The information space consists of items (i.e. physical places, events, or more abstract topics), contexts (categories of items used for search and recommendation issues), people and traces (implicit and/or explicit user interactions with the system). Main services include: enhanced topics of discussion, support for communities of people, matchmaking, awareness, semi-automatic creation and maintenance of personal diaries, personalized maps, advanced searching, time support and content generation (comments/ratings, insertion of new information). These are augmented with an enhanced digital map service for both the indexing and the visualization of the information along with a set of services regarding the suggestion of maximum interest paths, shortest paths, etc. The KB supports in a uniform manner diverse interaction means with completely different characteristics regarding both the computational and the presentation capabilities.

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