

A Social Media Based Tourist Information System

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Abstract

Smartphones are now equipped with various location sensing capabilities that allow the phone to accurately detect a user's physical location. Combined with other context data, this has provided a great deal of potential for developing context-aware mobile applications, which will greatly improve and change how users interact with mobile devices. An activity that can be greatly enhanced with the addition of context awareness is mobile tourism. Context-aware applications currently exist for a number of major cities worldwide. However, a common characteristic of these applications is the provision of too much irrelevant information. This is due to an over-reliance on location as a context and the lack of adequate information content filtering. A deluge of irrelevant or only partially relevant information can cause information overload for tourists using the application. Other context data can assist these applications in reducing information overload, but traditional implementations have tended to lack an adequate degree of personalisation. This research focuses on implementing context by building a level of intelligence into tourist based context-aware applications. This facilitates personalisation and provides focused and timely updates related to the tourist's current environment. This will be achieved through the application implicitly learning over time and dynamically updating personalisation settings. The application will present points of potential interest to the tourist based on their current personalisation settings. This should significantly improve the tourist experience when interacting with a context-aware mobile device. When the user initially launches the application there will be no historic data available for personalisation and so this paper explores the possibility of using social network data to build an initial information based stereotype for personalisation purposes. Another benefit of this approach is integrating the social aspect of tourism between willing participants. This facilitates real-time interaction between tourists as they traverse their current environment. This will in turn lead to valuable synergistic information flows between tourists as they explore their surroundings and hence lead to a better, more informed and rewarding tourist experience. These information flows can also be valuable for the tourist information service when analysing qualitative data regarding tourists visiting their city. Therefore, it is also imperative that mobile technology and social media are embraced by the tourism industry.

Keywords: Context-Awareness, Tourism, Mobile, Personalisation, Pervasive, Social Media.

1. Introduction

It is widely accepted that tourism can be a major factor in the revitalisation of a regional economy and in times of economic hardship local government will often consider improvements to the tourism

infrastructure (Iso et al., 2008). In order for tourism development to be sustainable it is essential to invest in Geographic Information Systems (Qiao et al., 2009). The majority of tourists visiting a city will either join a guided tour or use a map to explore alone (Ten Hagen, Modsching and Kramer, 2005). The problem with this is that both of these categories of tourists are almost certainly not getting an experience to match their interests as they are forced to join a group experience or use a map that is provided for all tourists (Kofler et al., 2011). Tourism is an industry that is information intensive. This is an additional problem as the magnitude of information that is accessible can sometimes lead to 'information overload' (Barta et al., 2009). Today's tourists expect to get access to tourist information at any time, from any place in their preferred medium (Schwinger et al., 2008).

A solution to these problems would be filtering information based on the user's personal preferences. This will reduce the 'information overload' problem and also provide a more personal solution so the tourist will receive more relevant information. The personalisation data will be dynamically generated and become more focused with application usage; therefore any informed assumptions will be refined over time. These assumptions will be used to rank and filter recommendations regarding locations of interest to visit. The ability for the user to view and edit the assumptions made by the application must also be included to ensure the user remains in control of the application (Schmidt-Belz et al., 2002). However, if the user is using the application for the first time there will be no usage history. In this case an informed stereotype will need to be generated based on the users' demographic. This could be completed by asking the user to complete an on-screen questionnaire to define such demographic information. However this is not viable as it is time consuming for the user to complete, especially if there are multiple pages of questions on a mobile device. A better option may be the automatic retrieval of this information from relevant social networks. For most people this would likely be the preferred option.

The data that the application is currently using for splitting users into demographic groups are; age, gender, relationship status and number of children. This is sufficient information to satisfy Wells and Gubar's study on 'Family Phases' within tourism (Bristor, 1985). However, this does not take into account demographic changes with the upsurge in levels of divorce, increase in the number of single parents and the growth in couples not having any children (Lawson, 1991). Therefore more phases are required to provide intelligent personalisation for the majority of the population. If these phases are not added then there is the danger that a larger proportion of the population will be listed as uncategorised and there will be no aspect of personalisation provided by the application for them.

Tourists are increasingly using social networks as a tool for information gathering. It is used for research before visiting an attraction and for sharing experiences during and after visiting the attraction (Haiyan, 2010). It is not used to the same degree as search engines, but with the integration of websites such as 'Trip Advisor' with social networks, use is growing. As a result, social media is a new channel that is being explored by tourist information services and used as another way to provide information to possible tourists (Xiang, Wober and Fesenmaier, 2008). However, there is little currently available that provides a real time information solution for the tourist when visiting a destination, possibly for the first time. The integration of social media with mobile devices can provide an opportunity to allow for peer review of points of interest and the ability for tourists to network with each

other in real time. This could provide the tourist with potentially multiple reviews (by other tourists in the vicinity), before visiting a point of interest or deciding if it was worth visiting. They could also communicate with other tourists in the area allowing them an opportunity to share services such as taxi's or provide strength in numbers for tourists travelling on their own.

2. Social Media

Due to the current rapid upsurge in the usage of social networks it is possible to find out a lot of information about a tourist using social media. When a user provides permission to an application it allows for the ability to find out information such as age, gender, relationship status, number of children and an abundance of other information. This information can be used to provide a greater context to the application and allow the application to adapt its behaviour to match the preferences of the user (Gallacher et al., 2011). The information can be integrated in order to generate personalisation factors that are important for tourism; for example a tourist's stage on the family cycle. The way that a tourist explores each destination is highly dependent on their stage on this cycle as this will have a major impact on the recommendations of the application (Moutinho, 2011).

Social media are emerging sources of online information that are created, initiated, circulated, and used by consumers with the intent of informing each other about products, brands, services and issues. In contrast to content provided by marketers and suppliers, social media are produced by consumers to be shared among themselves (Walden, Carlsson and Papageorgiou, 2011). This highlights the benefits of using social media in a tourism context; that is, the ability for tourists to generate and share information with others. This provides a potentially more reliable solution for tourists when researching travel, as they know it is more likely to be an unbiased review created by a person with no vested interest. The potential for using this type of information in real time is significant. For example if a museum is closed due to unforeseen circumstances a tourist could post this to a social media website and other tourists would then be able to take corrective action. In collectivist societies this will add to the current body of knowledge about a point of interest and be verified by other users that had a similar experience (Haiyan, 2010).

3. Context Awareness

Context is any information that can be used to characterise the situation of an entity. An entity is a persona, place, or object that is considered relevant to the interaction between a user and an application, including the user and the application themselves (Dey and Abowd, 2000). In order to provide an intelligent solution it is important that where possible, any available context data be used in the personalisation process. This will increase the validity of the information or services the application is offering the user (Abbaspour and Samadzadegan, 2008). Knowledge of location is important as the user will want information about the point of interest they are currently visiting (Teevan et al., 2011). However, there are other types of context that may be used in order to ensure the best possible recommendations. Time can be used to ensure that an attraction such as a museum or gallery is open before suggesting this to the user. This will ensure the tourist is not disappointed by trying to visit a closed attraction. Weather data and other potential sensor capabilities

can also help in the suggestion process. For example if it was raining outside, then indoor points of interest could be prioritised. The outdoor points of interest will be displayed so that the user remains in control, but they would be listed as a lower priority. The tourist will be a major contributor to the context of an application; the use of personalisation in the process of finding relevant points of interest will provide more relevant results (Buriano, 2006). It is important for the user to be able to change the information held by the application so the assumptions made are more relevant, this is why the points of interest should be sorted and not filtered out of the list (Schmidt-Belz et al., 2002).

4. User Profiling

Profiling can enhance the intelligence of a context-aware tourist application as once an application has been running for some time, it will implicitly learn and rely less on initial assumptions. However, it is important to get these initial assumptions correct, or the user may not continue to use the application due to the possibility of having a bad experience with the application. The first assumption that can be made is to use social network information to make an informed decision on which family cycle stage best suits the user (Wells and Gubar, 1966; Hong et al., 2005) as shown in table 1.

Variable	Measurement
Life Cycle Stages:	
Married without children	Age <55, married and no children
Full nest I	Age <40, married and children present
Full nest II	Age >40, married and children present
Empty nest	Age >55, married and no children
Single parents	All ages, unmarried and children present
Single	Age <55, unmarried and no children
Solitary	Age >55, unmarried and children absent
Others	All others

Table 1: Family Life Cycle Stages & Measurement (Hong et al., 2005)

'Family cycle' is not the only derivation that can influence travel behaviour; another factor is the purpose for the travel. If a tourist is travelling for Business or Educational reasons the type of activity they will take part in will be different from those travelling for Holiday or Visiting friends/family (Collins and Tisdell, 2002). It would in this case be difficult to make an assumption on the purpose of travel. It is a possibility that a user will be asked what the purpose for their travel will be the first time the application loads in a new destination. It would also be important for the user to change this option as the user may stay in a destination after a business trip and take a follow on vacation.

5. VISIT: A Contextual Tourism Application

The application developed as part of this study is known as VISIT (Virtual Intelligent System for Informing Tourists). It is a mobile application that uses various types of context such as location, time, weather and most importantly the current user (see Figure 1 & 2). Mobile location sensing technologies provide an accurate location down to a few metres. This location data is used to retrieve information about the current city and all points of interest in this city. Time will be used to ensure the points of interest are currently available before suggesting them to the user. The weather data will be

used to prioritise indoor points of interest when weather conditions are unfavourable. Social data is used in two ways; the first is to generate a family cycle stage using information such as age, gender, number of children and relationship status. Table 1 closely matches the ‘family cycle’ stages used within this application. The only change that was made refers to the ‘Married’ variable. A decision was made to also include engaged couples, civil partnerships and partners within this variable. Single will include divorced, separated and people that were never married (Drakopoulos, 2010). The second reason is to provide a social aspect to the user allowing them to add content to social media. This content can be shared with other willing application users in real time.

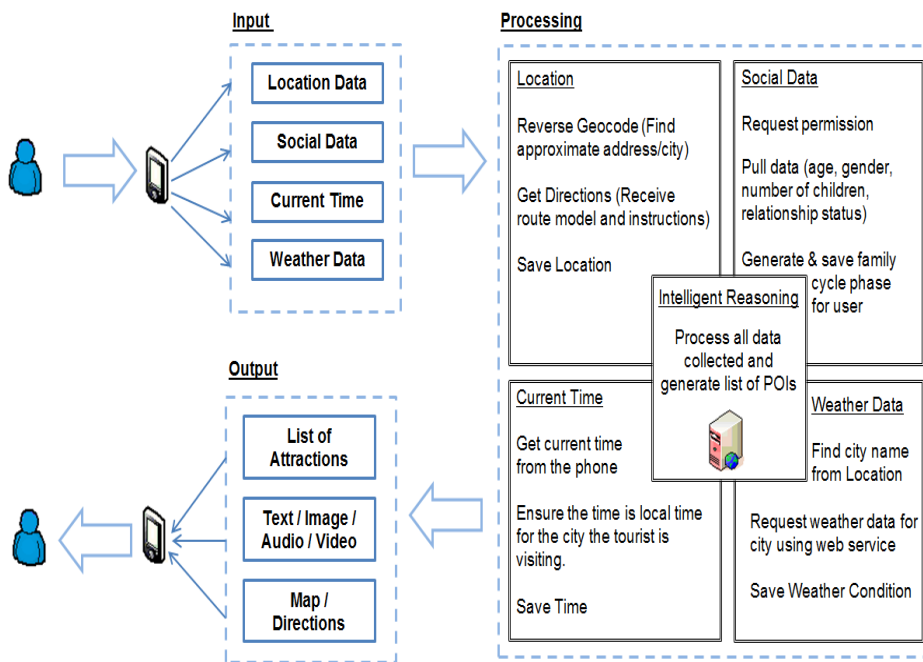


Figure 1: System Model



Figure 2: Prototype Design

6. Conclusion & Future Work

Tourist information systems are largely based on location, this is an important context in deciding where a tourist will visit, but it is not the only factor. The main aim of this study is to create a Virtual Intelligent System for Informing Tourists (VISIT). This system aims to provide an intelligent and as far as possible, implicit means of discovering the user's preferences and dynamically updating these preferences over time. It will utilise social media to build an initial profile to ensure personalisation aspects are correct from the initial start of the application. The application will allow tourists to share information with each other using social media and to read content created by other tourists in a real-time dynamic manner. Social media is becoming more important as a search tool for tourists and this project takes cognisance of this trend. Tourism can benefit greatly from embracing social media and mobile technology, as it provides a medium to communicate with tourists in real time. It also provides a forum for tourists to communicate with each other and an opportunity to deliver informative feedback during their stay. There is a lot of potential in rural tourism for this type of application as it does not require any further infrastructure. In this study a review of context-aware tourist applications has previously been conducted to ensure the uniqueness of the proposed application. Future work includes ensuring that all usable contexts are exploited in order to optimise a tourist's experience.

References

Abbaspour, R.A. and Samadzadegan, F. (2008) 'Building A Context-Aware Mobile Tourist Guide System Base on a Service Oriented Architecture', Proceedings of the 4th ISPRS Congress, Beijing.

Baillie, L. and Morton, L. (2009) 'Designing quick & dirty applications for mobiles: Making the case for the utility of HCI principles', International conference on Information Technology Interfaces, Glasgow, Scotland, 293-298.

Barta, R., Feilmayr, C., Proll, B., Grun, H. and Werthner, H. (2009) 'Covering the semantic space of tourism: an approach based on modularized ontologies', New York.

Bristor, J. (1985) 'Consumer Behaviour from a contemporary philosophy of science perspective: An organizational framework', *Advances in Consumer Research*, no. 12, pp. 300-304.

Broadbent, J. and Marti, P. (1997) 'Location aware mobile interactive guides: Usability Issues', International conference on hypermedia and interactivity in museums, Paris, France.

Buriano, L. (2006) 'Exploiting Social Context Information in Context-Aware Mobile Tourism Guides', Proceedings of Mobile Guide, Turin, Italy.

Choi, J. and Lee, H. (2012) 'Facets of simplicity for the smartphone interface: A structural model', *International Journal of Human-Computer Studies*, vol. 70, no. 2, February, pp. 129-142.

Collins, D. and Tisdell, C. (2002) 'Gender and Differences in Travel Life Cycles', *Journal of Travel Research*, vol. 41, no. 2, November, pp. 133-143.

Dey, A.K. and Abowd, G.D. (2000) 'Towards a better understanding of context and context-awareness', CHI 2000 Workshop on the what, who, where, when and how of context-awareness, London, 304-307.

Drakopoulos, G. (2010) *Demographic Change and Tourism*, Madrid, Spain: World Tourism Organisation and European Travel Commission.

Gallacher, S., Papadopoulou, E., Taylor, N., Blackmun, F., Williams, M., Roussaki, I., Kalatzis, N., Liampotis, N. and Daqing, Z. (2011) 'Personalisation in a System Combining Pervasiveness and Social Networking', 20th International Conference on Computer Communications and Networks (ICCCN), Maui, Hawaii, 1-6.

Haiyan, C. (2010) 'An impact of social media on online travel information search in China', International conference on Information management, Innovation management and Industrial engineering, Kunming, China, 509-512.

Hong, G., Fan, J., Palmer, L. and Bhargava, V. (2005) 'Leisure Travel Expenditure Patterns by Family Life Cycle Stages', *Journal of Travel & Tourism Marketing*, vol. 2, no. 18, pp. 15-30.

Iso, K., Mishina, T., Shimazaki, Y. and Ishibashi, T. (2008) 'Regional economic effect and ideal economic scale of tourism', IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), Yurihonjo, Japan, 857 - 861.

Kofler, C., Luz Caballero, M., Occhialini, V. and Larson, M. (2011) 'Near2me: An authentic and personalized social media-based recommender for travel destinations', The Third ACM SIGMM Workshop on Social Media, Scottsdale, AZ, 47-52.

Lawson, R. (1991) 'Patterns of tourist expenditure and types of vacation across the family life cycle', *Journal of Travel Research*, vol. 4, no. 29, April, pp. 12-18.

Moutinho, L. (ed.) (2011) *Strategic Management in Tourism*, 2nd edition, Oxfordshire, UK: CAB International.

Qiao, L., Zhang, Y., Zhang, W., Mao, D. and Yao, L. (2009) 'Application of GIS Technology in Chinese Tourism', International Conference on Environmental Science and Information Application Technology (ESIAT), Xinxiang, China, 401 - 404.

Schmidt-Belz, B., Achim, N., Poslad, S. and Zipf, A. (2002) 'Personalized and location-based mobile tourism services', In Proceedings of Mobile-HCI Conference, Pisa.

Schwinger, W., Grun, C., Proll, B., Retschitzegger, W. and Schauerhuber, A. (2008) 'Context-awareness in Mobile Tourism Guides', *Handbook of Research on Mobile Multimedia, Second Edition*, vol. 2, pp. 298 - 314.

Teevan, J., Karlson, A., Amini, S., Bernheim, A. and Krumm, J. (2011) 'Understanding the Importance of Location, Time, and People in Mobile Local Search Behaviour', Mobile HCI, Stockholm, Sweden.

Ten Hagen, K., Modsching, M. and Kramer, R. (2005) 'A Location Aware Mobile Tourist Guide Selecting and Interpreting Sights and Services by Context Matching', The Second Annual International Conference on Mobile and Ubiquitous Systems: Networking and Services, San Diego, 293-304.

Walden, P., Carlsson, C. and Papageorgiou, A. (2011) 'Travel information search - The presence of social media', 44th Hawaii International Conference on System Sciences, Kauai, Hawaii, 1-10.

Xiang, Z., Wober, K. and Fesenmaier, D. (2008) 'Representation of the online tourism domain in search engines', *Journal of Travel Research*, vol. 47, no. 2, pp. 137-150.