The Design and Development of a Mobile Commerce for Tourism Framework

Jintana Khemprasit*
Department of Information Systems, Rajamangala
University of Technology ISAN

Pensiri Phoriya
Department of Information Systems, Rajamangala University of Technology ISAN

Tanet Boonyasethakul
Department of Information Systems, Rajamangala University of Technology ISAN

Rattapornrat Ngamwong
Department of Information Systems, Rajamangala University of Technology ISAN

ABSTRACT

Currently, the growth of mobile commerce is significantly increasing worldwide. Meanwhile, tourism has taken on an important economic role as a significant source of income for several countries. Consequently, this paper focuses on the design of mobile commerce for tourism for the purpose of attracting tourists. However, none of the previous research provides a mobile commerce framework for tourism that involves fundamental m-commerce functions (ordering, payment, reservation) and additional functions (product searching by location, trip recommendations, travel planning, and marketing services). Consequently, this study aims to develop a comprehensive m-commerce framework for tourism that covers both of these fundamental and additional functions. In order to design such a framework, data was collected from both primary and secondary sources. After that, the proposed mobile commerce for tourism framework was derived based on service oriented architecture (SOA). SOA is a concept to structure a system to supports data exchange among organizations in different formats and across platforms. Finally, the efficiency and effectiveness of the system will be measured to propose a framework that can enhance the performance of mobile commerce activities and can achieve the satisfaction of tourists.

1. INTRODUCTION

The number of smartphone users is significantly increasing worldwide. Between 2014 and 2016, the number of smartphone users rose from 1.59 billion to 2.08 billion. The number of smartphone users is forecast to reach 2.65 billion by 2019 [1]. Smartphones have some unique characteristics including their ubiquity, localization, personalization and convenience. With these characteristic, smartphones have become

the most popular portable communication device. Currently, there are several mobile applications available. A survey by MasterCard found that nearly half (45.6%) of Asia Pacific consumers have embraced the convenience of mobile shopping by making purchases using their smartphones. Convenience is the main factor motivating consumers to use their smartphones to shop [2]. Overall, consumers from China (70.1%), India (62.9%) and Taiwan (62.6%) are the most likely to shop using their smartphones. In terms of the biggest growth in mobile shopping, Taiwan and India lead the region with the number of people shopping on smartphones, more than doubling over two years [2].

Moreover, the data from a statistics portal [1] projects that mobile commerce revenue worldwide will significantly increase from 2013 to 2018. In 2014, global mobile commerce revenues amounted to 184 billion U.S. dollars and are projected to reach 669 billion U.S. dollars in 2018.

This paper focuses on applying m-commerce in the tourism industry. Tourism has an important role in the economies of developing countries. For several countries, it is the main source of income. The primary benefits of tourism are income creation and generation of jobs [3]. In order to achieve the benefits of tourism, investment in the necessary infrastructure and the appropriate information technology is needed to develop the tools to meet the demands of tourists. For example, tourists can search information about travel destinations and their associated resources, such as accommodations, restaurants, and museums to plan trips using Internet technology. Currently, much research focuses on methods to attract tourists including recommendation, travel planning, and mobile payment methods. However, none of the current research provides a comprehensive m-commerce framework for tourism that has fundamental m-commerce functions (ordering, payment, reservation) or additional functions to support tourism (product searching by location, personalized trip recommendations, travel planning before and during travel, and marketing services). Consequently, this paper aims to develop a comprehensive m-commerce framework for tourism that covers both of these types of m-commerce functions. Moreover, the proposed framework was developed based on service oriented architecture (SOA), which supports data exchange among organizations in different formats and across various platforms, since m-commerce needs to exchange information with multiple organizations.

This paper follows a systematic approach in reviewing the state-of-the-art of mobile commerce. Trends of mobile phone usage and mobile commerce are reviewed. The gap of m-commerce is explored and a novel idea in m-commerce for tourism is presented. The reminder of this paper is structured as follows: Section 2 reviews the related literature about mobile commerce for tourism, travel planning and recommendation systems for m-commerce. Section 3 explains developments in mobile commerce for tourism. Section 4 presents a proposed mobile commerce framework for tourism, and, Section 5 summarizes the findings and suggest avenues for future work.

2. RELATED WORK

This research is an application of mobile devices that provide mobile commerce features for tourism. These include ordering, making payments, searching for information with regards to location, destination recommendations and travel planning. Consequently, this research focuses primarily on three areas, mobile

commerce for tourism, travel planning, and a recommendation system for mobile commerce.

2.1 Mobile commerce for tourism

The definition of m-commerce has been given from different perspectives. Chong AY-L [4] described m-commerce as "*any transaction, involving the transfer of ownership or rights to use goods and services, which is initiated and/or completed by using mobile access to computer-mediated networks with the help of mobile devices*". M-commerce is different from e-commerce based on the network medium and device as well as its difference in interaction styles, usage patterns, and value chain [5]. Mahatanankoon et al. [6] categorized m-commerce activities as content delivery, transactions, location-based services, emergency assistance, and entertainment purposes. Such classifications are consistent with Pagani [7] and Ngai and Gunasekaran [8]. Similarly, these classifications were adopted by [4] who divided m-commerce into four activities, content delivery, transactions, location based service and entertainment.

This study aims to propose a comprehensive m-commerce framework for tourism which will adopt the uses discussed by Mahatanankook et al. [6] and divide m-commerce into three activities. First, delivery of content deals with using a mobile application to search for and find location relevant tourist information. Second, transactions involve using a mobile device to do business activities such as ordering, payment and reservation. Third, location based services involve doing travel planning, receiving trip recommendations trip and searching for tourist information based on the location of the user.

2.2 Travel planning

Traveling is a very important activity in a modern society. Traveling may involve trips planned by travel agencies or self-planned itineraries. Trips planned by travel agencies usually include some tourist attractions, scheduling and the routing. Self-planned itineraries are developed by the tourists themselves. Consequently, they need to search for trip information from multiple sources, e.g., tourism websites, review boards, and friends, among others. Currently, there are several studies in travel planning focusing on new techniques using modern information technologies to provide appropriate travel planning information to tourists. For example, a data mining application called *'Trip-Mine'* was used to plan a trip that satisfies multiple user-specific constraints. Furthermore, the cloud-based applications can be used to meet personal requirements [9]. Google Maps was used to develop travel a planning platform. When tourists register on this platform, they receive travel information from the reviews of members who previously took a particular trip [10]. A weighted method was used to design a path algorithm to minimize the cost of distant travel planning. Moreover, during a trip, tourists can use blogs and Google Earth to show the times and locations of events in a real-time system using a location based service and GPS on a mobile device [11].

In the studies discussed above, travel planning has attracted extensive attention of a number of researchers. Consequently, this paper aims to find a novel travel planning method that uses mobile commerce in a tourism framework which can impact and delight users of mobile commerce.

2.3 Recommendation system for mobile commerce

Recommendation systems play an important role in mobile commerce for tourism since they are method to reduce information overload and offer travel recommendations to tourists [12]. A recommendation system can be categorized into one of six groups based on their target applications, the knowledge used, the way they formulate recommendations and the algorithms they implement [12-14]. First, collaborative filtering is a method to recommend items similar to those chosen by other users with similar preferences [15]. Second, content-based filtering is a method to use the content items that the target user has viewed in previous interactions [16]. Third, knowledge-based filtering is a method to use a knowledge-base to generate recommendations, by reasoning about what items meet the user's requirements [17]. Fourth, demographic filtering is a mainly used in marketing. This method recommends products based on user's demographic profile [18]. Fifth, matrix factorization is a method that is comprised of collaborative filtering and the general deviation rating of a user [19]. Lastly, hybrid recommendations are made by combining the above mentioned methods, using appropriate methods for each problem [20].

Currently, the popular websites for tourist recommendations are now operational in a major tourism portal. These websites have the same objective, to advise tourists about their trip, but they employ different methods. For example, Heracles [21] uses content-based filtering on tourist information mined throughout various online data sources and search engines. TripSay [22] uses a collaborative filtering-based approach to match destinations, places, sights, content and activities, leveraging the user's network of friends as well as those with similar preferences. TripAdvisor [23] advises about trips, locations and activities for user and also provides rated scores by other tourists to assist in the complex decision-making process. DieToRecs [24] provides a selection of travel products by building a travel bag. DieToRecs also supports multiple decision styles, i.e., iterative single-item selection, complete personalized trip selection and inspiration driven selection.

It can be seen that there are several ways to recommend trips for targeted users depending on the selection method. This study proposes to employ a hybrid recommendation system that makes content, demographic, and knowledge based suggestions (represented by an ontology) and then combing them into one model.

3. MOBILE COMMERCE FOR TOURISM FRAMEWORK DEVELOPMENT

An m-commerce for tourism framework was developed by collecting data from primary and secondary sources. Initially, the secondary source was a comprehensive literature and a tourism authority document review. Next, the primary sources included interviewing and surveying tourists, hotel staff and owners of community products. This is represented in Figure 1.
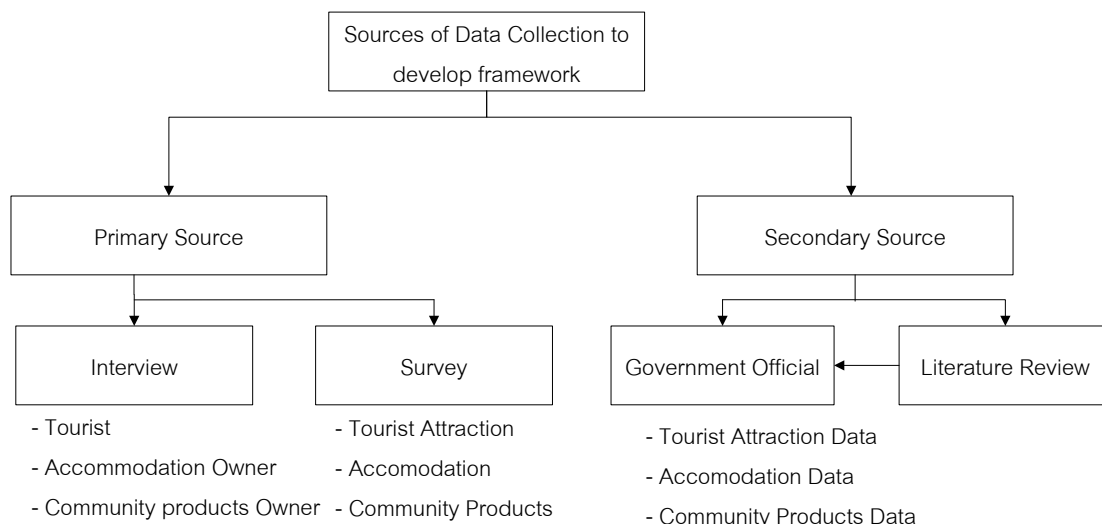
Figure 1. Sources of data to develop an m-commerce framework

3.1 Review from the secondary sources

There were two secondary sources of data, i.e., a literature review and a tourism data review. The literature review focused on studying previous research in mobile commerce, tourism, travel planning, and recommendation systems. The tourism data review focused on studying the tourist offerings, e.g., attractions, office hours, accommodations, and community products, among others.

M-commerce activities were classified into five types, content delivery, transactions, location-based services, emergency services and entertainment. Content delivery is an activity for finding information using a mobile device. Transactions transfer money between consumers and businesses. Location-based services employ the current location of a mobile user to conduct m-commerce activities such as receiving personal advertisement and receiving discount tickets. Entertainment is activity using mobile devices for entertainment purposes such as playing games or watching movies.

The tourism data was collected from the government official who takes responsibility on tourism, e.g., tourist attraction data, accommodation data and community product data.

3.2 Investigation from the primary sources

There were two primary sources of data, i.e., interviews and surveys. These were conducted to collect information relevant to factors affecting trip planning, e.g. demographics, lifestyle, tourist type, occupation, and education among others.

4. PROPOSED MOBILE COMMERCE FRAMEWORK FOR TOURISM

A mobile commerce for tourism framework was derived based on SOA as depicted in Figure 2. The proposed framework has three layers, i.e., application, service and a database/infrastructure layers.
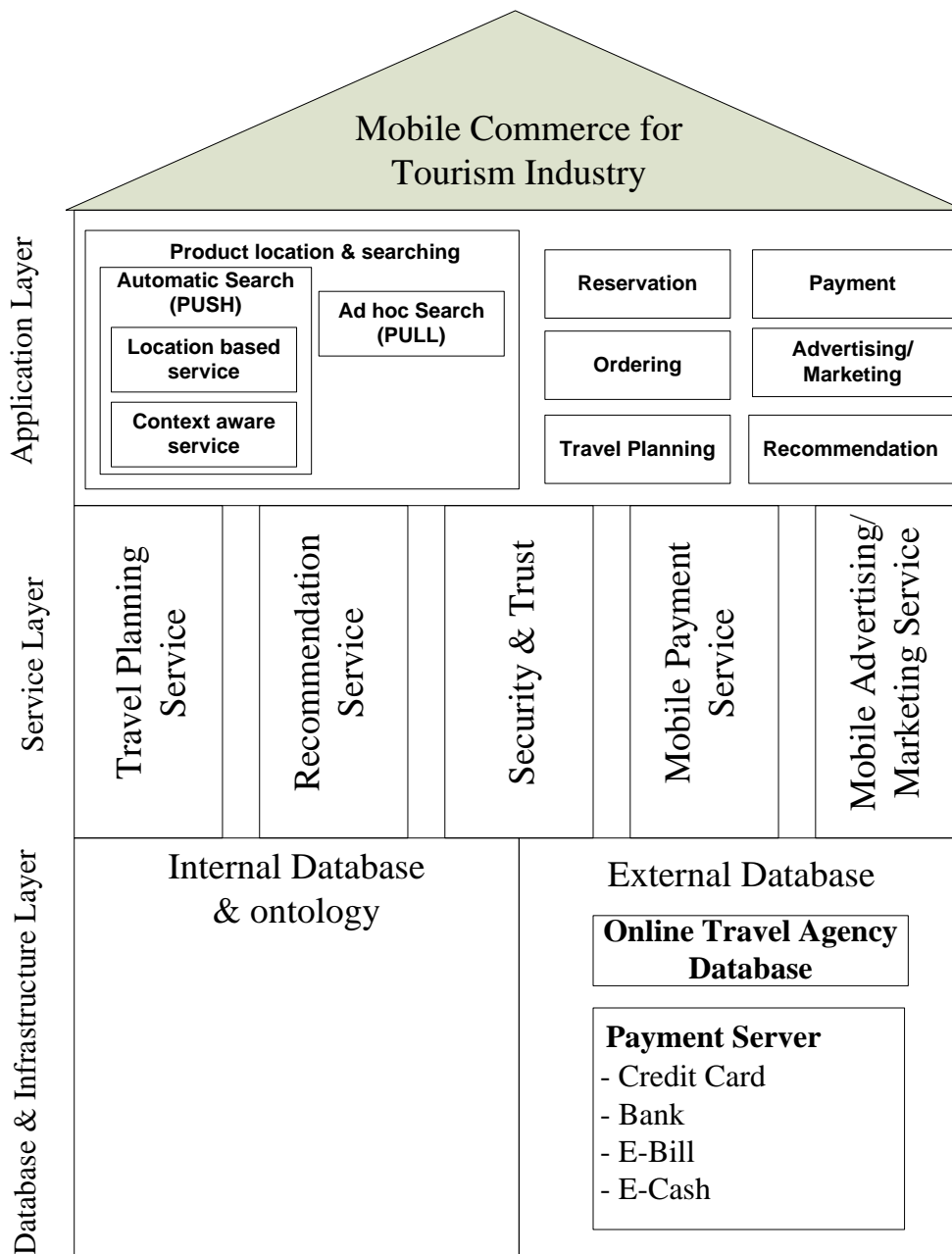

Figure 2. Mobile Commerce for Tourism Industry Framework

The application layer is a collection of m-commerce functions to achieve the objectives of m-commerce activities. The relationships between the m-commerce activities and the m-commerce functions for tourism are shown in Table 1.

Table 1: The relationship between m-commerce activities and functions for tourism

M-commerce activities	M-commerce functions for tourism
Content Delivery	Product location and searching 1. Automatic search by location and context awareness (PUSH) 2. Ad hoc search (PULL)
Transactions	Ordering, Payment, Reservation
Location based service	Advertising, Marketing, Travel planning, Trip recommendation

The service layer is a fundamental component of a SOA. This layer provides services that can be used across heterogeneous systems. The service layer contains core services that encapsulate business logic specific to a tasks or business processes [25]. The service layer contains travel planning, recommendation, security & trust, mobile payment, mobile advertising and marketing services. The travel planning service provides functions for self-planned itineraries that consider multiple constraints (time, money, personalized requests). The recommendation service provides the functions for trip suggestions using a hybrid recommendation method that is content, demographic and knowledge based. The security & trust service provides security features for the system by authenticating user identity and user roles during log in. The mobile advertising and marketing services provide functions to achieve the objectives of marketing management, for example, sending personal advertisements, offering discounted tickets.

The database and infrastructure layer is a collection of an internal database & ontology, and external databases. The internal database contains tourism data (tourist attractions, office hours and accommodations, and ontology is a representation of tourist attractions and tourist's personalization. The external databases are an online travel agency database and payment server.

5. CONCLUSIONS

A mobile commerce for tourism framework was proposed in this paper based on data collected from both of primary and secondary sources to design and develop a framework. The proposed framework is based on an SOA consisting of three layers, i.e., application, service and database & infrastructure layers. These layers were designed to cover most of the system requirements. The application layer contains the m-commerce functions for tourism. The service layer contains core services that encapsulate the business logic specific to tasks such as logic for travel planning with multiple constraints. The database & infrastructure layer contains the internal and external databases.

For future work, a detailed design and the implementation of a mobile commerce framework for tourism will be done. Finally, system efficiency will be measured, so that the proposed framework can enhance the performance of m-commerce activities.

Its effectiveness will be determined to learn how the proposed framework can achieve the satisfaction of tourists.

REFERENCES

1.   The Statistic Portal, *The Statistic Portal.*   [cited 2016 April 20]; Available from :http://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/.

2.   MasterCard. *MasterCard.* 2016   [cited 2016 April 20]; Available from: http://www.newsroom.mastercard.com.

3.   Agaraj X, Murati M. *Tourism an Important Sector of Economy Development: Economic and Low Faculty*, Tourism Mi,2009.

4.   Chong AY-L. *Mobile commerce usage activities: The roles of demographic and motivation variables.* Technological Forecasting & Social Change,2013. **80**(2013): p.1350-9.

5.   Hoegler T, Stucky W, editors. *Exploring the critical success factors for mobile commerce.* International Conference on Mobile Business, 2015.

6.   Mahatanankoon P, Wen HJ, Lim B. *Cosumer-based m-commerce: exploring consumer perception of mobile applications.* Journal of Computer Standards & Interfaces2005. **27**(4):p.347-57.

7.   Pagani M. *Determinants of Adoption of Third Generation Mobile Multimedia Service.* Journal of Interactive Marketing 2004.**18**(3): p.46-59.

8.   Ngai EWT, A.Gunasekaran. *A review of mobile commerce research and applications.* Decision Support System 2007.**43**(1): p.3-15.

9.   Ying J-C, Lu EH-C, Huang C-M, Kuo K-C. *A framework for clound-based POI search and trip planning systems.*   International Conference on Orange Technologies (ICOT), 2013; 12-16 March 2013; Tainan: IEEE. 2013: p. 274-7.

10. Chung-Hua C, Chenyang H. *A Platform for Travel Planning by Using Google Maps.*   International Conference on Mobile Data Management 16th 2015; 15-18 June 2015; Pittsburgh, PA: IEEE; 2015. p. 120-5.

11. Hung JC, Lee YH. *Constructing an intelligent travel information platform*

based on Location Base Service. Joint Conferences on Pervasive Computing (JCPC); 3-5 Dec. 2009; Tamsui, Taipei: IEEE; 2009. p. 845-50.

12. Gavalas D, Konstantopoulos C, Mastakas K, Pantziou G. *Mobile recommender systems in tourism.* Journal of Network and Computer Applications,2013. **39(**2014): p.319-33.

13. Adomavicius.G, Tuzhilin.A. *Toward the next generation of recommender system: a survey of the state-of-the-art and possible extensions.* IEEE Transactions on Knowledge and Data Engineering,2005.**17**(6): p.734-49.

14. Ricci.F, Rokach.L, Shapira.B. *Recommender systems handbook.* Springer Science,2011.

15. Breese.JS, Heckerman.D, Kadie.C, editors. *Empirical analysis of predictive algorithms for collaborative filtering.* The 14th conference on uncertainty in artificial intelligence (UAI'98), 1998.

16. Pazzani.MJ. A framework for collaborative, content-based and demographic filtering. Artificial Intelligence Review,1999;**13**(5): p.393-408.

17. Trewin.S. *Knowledge-based recommender systems.* Encyclopedia of Library and Information Science.2000, 69(32): p.69-180.

18. Pazzani.MJ. *A framework for collaborative, content-based and demographic filtering.* Artificial Intelligence Review.1999, **13**(5): p.393-408.

19. Koren.Y, editor. *Factorizaion meets the neighborhood: a multifaceted collaborative filtering model.* Procedding of the 14th ACM SIGKDD international conference on knowledge discovery and data mining, 2008.

20. Burke.R. *Hybrid recommender systems: survey and experiments.* User Modeling and User-Adapted Interaction. 2002,**12**(4): p.331-70.

21. Heracles. Heracles. 2016 [cited 2016 2016 January 5]; Available from: http://www.isi.edu/integration/Heracles.

22. TripSay. 2016 [cited 2016 January 10]; Available from: http://www.tripsay.com.

23. TripAdvisor. 2016 [cited 2016 January 10]; Available from: http://www.tripadvisor.com.

24. DieToRecs. DieToRecs. 2016 [cited 2016 Janurary 15]; Available from: http://www.modul.ac.at/dietorecs.

25. Khemprasit J, Esichaikul V. *SOA-Based Mobile Application for Crime Control in Thailand.* World Academy of Science, Engineering and Technology,2011.