Intelligent Personalization of Thai M-commerce as Marketing Value-added Services Tool

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Abstract- Mobile commerce (m-commerce) or e-commerce over mobile devices, has become a major topic of interest for the information systems research community and a key priority for many business organizations. However, m-commerce includes a large range of various services, especially with regard to numerous value-added services. Since Thailand small and medium enterprises have been transformed themselves from traditional business to digital business using Internet and e-commerce. This research made the Thai e-commerce on supporting features of the m-commerce: mobile commerce with short message service (SMS) and multimedia message service (MMS). The most promising technology item-based collaborative filtering scheme for the seller to create an element of personalization for each individual consumer. This case-study of Thai cake ordering m-commerce system presented in order to provide the general business models, the theoretical concerns and the relevant systems for ordering. Doing business through m-commerce provides new and greater opportunities for customer-supplier interaction.

I. INTRODUCTION

Mobile phones have become one of the most popular communication devices among most of the people around the world, and Short Message Service (SMS) is popular among mobile phone users as a cheap and convenient method of communicating. Therefore, SMS technology is a common feature with all mobile network service providers. Moreover, the improvement of wireless technology involved a new era for electronic commerce. Mobile commerce (m-commerce) is a type of e-commerce that conducts business transactions via mobile devices. Due to its inherent characteristics such as ubiquity, personalization, flexibility and dissemination, m-commerce promises businesses unprecedented market potential, great productivity and high profitability [1]. Multimedia Messaging Service (MMS) is the wireless messaging technology which is able to deliver rich media. The technological advances in information and communications technology has given rise to more innovative forms of business transactions [2]. M-commerce is a subset of e-commerce conducted through mobile phone devices using wireless telecommunications network is poised to change the market place globally [3]. Recorded show that by 2008, total e-commerce spending by consumers and businesses could surpass $ 7 trillion, Thailand is a country with considerable potential [4]. Thailand Internet trend is excited at 20.5 % of the population (with about 13.4 million people in March 2009).

By end-2007 around 913,000 of all Internet users had broadband connections, according to the National Electronic and Computer Technology Center (NECTEC) the internet users who used online shopping were 45.9% increased in 2008. In 2008, Thai small and medium enterprises (SME) are around 858,291 shops which equals to 85% of all business. Of this SME business around 100,000 shops have their own website (NECTEC, 2008). Another increasing popular function is the SMS and MMS. AIS which is one of the largest mobile phone service providers in Thailand, indicates that Thai people send 41 million of SMSs and 7.5 hundred thousand of MMSs in the range of date between 31 December in 2007 and 1 of January in 2008. Based on the statistics, it emphasizes on the dramatic rate of using SMS and MMS.

Since the use of SMS and MMS technologies are cheap, convenient and flexible way of conveying data, researchers are trying to apply this technology in supporting the e-commerce that were provided by service providers at present. One of such areas that the SMS and MMS technologies could be used as a cost effective and more flexible way be remote monitoring and controlling. These uncertainties have affected virtually all value-added product and service offerings. Nevertheless, different groups will have varying opinions of the usefulness of certain value-added services. One group may have a high opinion of a specific value-added service feature, whereas another group may completely reject this value-added offering. This phenomenon occurs due to varying expectations of value-added services’ demand. Now, mobile phone users in Thailand regularly use cell phone communication, but with relatively few value-added services; nevertheless, promotion and acceptance of other value-added services has been somewhat disappointing. So, this research focuses on the values added of the e-commerce for moving along to the m-commerce value propositions. The value propositions theorized by Clarke [5] Ubiquity, localization, convenience and personalization define the relationship between possible supplier offerings and consumer purchases, by identifying how the supplier fulfills the customer’s needs across different consumer roles. The researchers developed a web for residing the collaborative filtering program. On mobile, an m-commerce which consists of the features of SMS and MMS was made. The method of item-based collaborative filtering used to execute collaborative filtering, two stages are prediction and recommendation [5]. The researchers decided
to use “the cake” to be the product online. Since designing “the cake” pictures using MMS technology is suitable for personalization characteristic.

II. RELATED RESEARCHS

A. Value-Added Service : Personalization

Mobile commerce operates within three main roles: mobile telephone providers, system service providers, as well as end users. Mobile commerce means different things to different people. To customers, it represents convenience, whilst merchants associate it with a huge earning potential; and service providers view it as a large unexplored market [6]. Therefore, it is apparent that different people have different views about this concept. The research of Kini and Thanarithiporn [3] found that in Thailand users seem to believe that general content such as news, weather and sports should be low-cost or free. However, innovative pricing schemes and services are expected to attract more users. Thus, the understanding of the value space between e-commerce and m-commerce is becoming important, so innovative services can be targeted to attract more users towards m-commerce. In this study, the authors have been able to identify that “ubiquity” or “everywhere available” value drives the adoption and usage of mobile device as theorized in earlier research.

Clarke [5] hoped to create a sufficient mobile commerce strategy through research of value propositions. The researcher found that this can provide managers with a reference for developing a good marketing strategy in this newly wireless environment. Value propositions define the relationship between supplier offerings and consumer purchases by identifying how the supplier fulfills the customer’s needs across different consumer roles.

Clarke [5] defines value propositions for m-commerce into four levels. An concise explanation of each of the four value propositions for m-commerce are:

1. Ubiquity : Mobile devices offer users the ability to receive information and perform transactions from virtually any location on a real-time basis.
2. Localization : Location-specific information leverages the key value proposition of m-commerce over traditional e-commerce by supplying information relevant to the current geographic position of the user. M-commerce providers will be able to both push and access information relevant to the users specific location.
3. Convenience : The agility and accessibility provided from wireless devices will further allow m-commerce to differentiate its abilities from e-commerce. People will no longer be constrained by time or place in accessing e-commerce activities. Rather, m-commerce could be accessed in a manner which may eliminate some of the labor of life’s activities.
4. Personalization : Mobile devices are typically used by a sole individual, making them ideal for individual-based target marketing. Mobile offers the opportunity to personalize messages to various segments, based upon time and location, by altering both sight and sound.

B. Personalization of M-commerce in Practice

One of the greatest benefits of m-commerce is its ability to match products and services with individual consumers. Such a match is a part of one-to-one marketing, which treats each customer in a unique way to fit marketing and advertising with the customer’s needs. The ability of m-commerce to match individuals with products/services and/or with advertising includes personalization or customization of products/services (“make it your way”). The benefits of doing business over the Internet is that it enables companies to better communicate with customers and better understand customers’ needs and buying habits.

The key issues related to one-to-one marketing personalization, collaborative filtering, customer loyalty, and trust. Personalization refers to the matching of services, products, and advertising content to individuals[6]. The matching process is based on what a company knows about the individual user. This knowledge is usually referred to as a user profile. The user profile defines customer preferences, behaviors, and demographics. Once a company knows a consumer’s preferences, it would be useful if the company could predict, without asking, what other products or services this consumer might enjoy. One way to do this is through collaborative filtering, which uses customer data to infer customer interest in other products or services. This prediction is based on special formulas derived from behavioral sciences. Recommender systems apply data analysis techniques to the problem of helping users find the items they would like to purchase at e-commerce sites by producing a predicted likelihood score or a list of top-N recommended items for a given user. Item recommendations can be made using different methods. Recommendations can be based on demographics of the users, overall top selling items, or past buying habit of users as a predictor of future items. Collaborative Filtering (CF) [7] is the most successful recommendation technique to date. The basic idea of CF-based algorithms is to provide item recommendations or predictions based on the opinions of other like-minded users.

C. The Item-based Collaborative Filtering Recommendation Model

From the experimental evaluation of the item-item collaborative filtering scheme, sarwar and his friends [8] make some important observations. The item-item scheme provides better quality of predictions than the user-user (k-nearest neighbor) scheme. The improvement in quality is consistent over different neighborhood size and training/test ratio. However, the improvement is not significantly large. The item-based approach looks into the set of items the target user has rated and computes how similar they are to the target item and then selects k most similar items \( \{i_1, i_2, \ldots, i_k\} \). At the same time their corresponding similarities \( \{s_{i_1}, s_{i_2}, \ldots, s_{i_k}\} \) are also computed. Once the most similar items are found, the prediction is then computed by taking a weighted average of
the target user’s ratings on these similar items. The aspects, namely, the similarity computation using Cosine-based similarity and the prediction generation using weighted sum. One critical step in the item-based collaborative filtering algorithm is to compute the similarity between items and then to select the most similar items. The basic idea in similarity computation between two items \( i \) and \( j \) is to first isolate the users who have rated both of these items and then to apply a similarity computation technique to determine the similarity \( s_{ij} \). Figure 1, illustrates this processes; here the matrix rows represent users and the columns represent items.

![Figure 1. Isolation of the co-rated items and similarity computation][1]

1. Correlation-based Similarity [8]

   In the case, similarity between two items \( i \) and \( j \) is measured by computing the Pearson-r correlation \( corr_{ij} \). To make the correlation computation accurate we must first isolate the co-rated cases (i.e., cases where the users rated both \( i \) and \( j \)) as shown in Figure 1. Let the set of users who both rated \( i \) and \( j \) are denoted by \( U \) then the correlation similarity is given by

\[
\text{sim}(i, j) = \frac{\sum_{u \in U} (R_{u,i} - \bar{R}_i)(R_{u,j} - \bar{R}_j)}{\sqrt{\sum_{u \in U} (R_{u,i} - \bar{R}_i)^2} \cdot \sqrt{\sum_{u \in U} (R_{u,j} - \bar{R}_j)^2}}
\]

Here \( R_{u,i} \) denotes the rating of user \( u \) on item \( i \), \( \bar{R}_i \) is the average rating of the \( i \)-th item.

2. Weighted sum [8]

   As the name implies, this method computes the prediction on an item \( i \) for a user \( u \) by computing the sum of the ratings given by the user on the items similar to \( i \). Each ratings is weighted by the corresponding similarity \( s_{ij} \) between items \( i \) and \( j \). Formally, we can denote the prediction \( P_{u,i} \) as

\[
P_{u,i} = \frac{\sum_{all \ similar \ items, \ N} (s_{IN} \cdot R_{u,N})}{\sum_{all \ similar \ items, \ N} (s_{IN})}
\]

Basically, this approach tries to capture how the active user rates the similar items. The weighted sum is scaled by the sum of the similarity terms to make sure the prediction is within the predefined range.

D. M-commerce Infrastructure in Thailand

Mobile computing infrastructure in addition to the value-added attributes of m-commerce is driven by these factors: (1) Widespread availability of devices, (2) the handset culture (3) the vendors’ push, (4) declining prices and improvement of bandwidth[9]. The number of cell phones throughout the world exceeds. Over 50 percent of the new phones in production have color screens. It is estimated that within a few years, about 70 percent of cell phones have Internet access. Thus, a potential mass market is available for conducting m-commerce. Cell phones are spreading quickly in Thailand, especially in Bangkok and big cities. SMS is a national phenomenon in the Thai youth market. To properly conduct m-commerce, it is necessary to have sufficient bandwidth for transmitting text; however, bandwidth is also required for voice, video, and multimedia. In Thailand, the 2.5G technology is used to provide that, at a data rate of up to 2 mbps. This enables information to move seven times faster than when 56K modems are used. The 2.5G, an interim technology based on GPRS (General Packet Radio Service) and EDGE (Enhanced Data GSM Environment) that can accommodate limited graphics. In addition to the hardware m-commerce also requires wireless WAN infrastructure, a WAP gateway, a database server, a GPS locator.

The major software products required for m-commerce include the following: Back-end legacy application software. Legacy software that resides on large UNIX servers is a major part of m-commerce software because it provides the back-end systems. Application middleware. Middleware is a piece of software that communicates with back-end legacy systems and Web-based application servers. IBM’s Web Sphere is one such example. Wireless middleware. Wireless middleware that links multiple wireless networks to application servers is also needed. Wireless Application Protocol (WAP) is a set of communication protocols designed to enable different kinds of wireless devices to talk to a server installed on a mobile network so that users can access the Internet. It enables the deployment of a micro browser in mobile devices. WAP includes Java-based applications (the J2ME platform), which offer better graphics and security.

III. RESEARCH DESIGN

A. Research Process

This research focuses on individual cases of current domestic cell phone value-added services offer in Thailand. When a sale is made, customer information is collected and then is placed in the database using MySQL DBMS. Then, a customer’s profile is developed and the so-called “Four P’s” of marketing (product, place, price, and promotion) are generated on a one-to-one basis. Based on this individualized profile, appropriate advertisements are prepared that will hopefully lead to another purchase by the customer. Once a

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[1]: Figure 1. Isolation of the co-rated items and similarity computation [5]
purchase is made, the detailed transaction is added to the database. The first part of online purchasing was done in the Web environment using PHP program on windows XP professional. The SMS that allows for the sending of short text message from cake order customers to the vender and opposite vender part to the customers for appointed receiving cakes. The MMS which will be able to deliver rich media of cake pictures for two sides commitment of cake ordering. The Internet-enabled cell phones that can support mobile application are the Nokia series and other compatible ones. From this point, the experimental data from the research website was used the personalized item-based recommendational algorithm. The propositions of ubiquity, localization, and convenience characteristics are addressed by four largest telecommunication providers (with the using of WAP/GPRS) namely AIS, DTAC, True move and Hutch [10, 11, 12, 13]. Beside using PHP for the webpage application, the Macromedia Dreamweaver and Macromedia Flash were used to design and make the multimedia. For the mobile part, the WAP application, SMS and MMS were written using J2ME language. The ODBC is for connecting the database and the website.

B. The Example Scenario

A scenario of m-commerce services for the cake-ordering application. From the database, Somchai’s calendar system reminds him that today is his daughter birthday. The intelligent program receives the information then solicits information from the user and then builds the profile from previous purchase pattern from the databases. In this stage the collaborative filtering based recommender systems using item based recommendation model was used to find out the suitable outputs proposing to the customer. The reminder MMS comes with a set of personalization promotions and a menu offering to help Somchai order the cake for his daughter. In the simplest variation of our scenario, Somchai first clicks on the order cakes option, selects from a number of online cake patterns, arranges for payment, then waits for the SMS confirming the time and place for sending cake.

IV. RESULTS

The Thai cake ordering e-commerce website shown the first home page in Figure 2. There are the menu of the various promotions and the catalogs.
The confirmation WAP for the user to click on and the confirmation messages from the system to the customer as shown in figure 5.

![Confirmation Window](image)

Figure 5. The confirmation window

V. CONCLUSIONS

Increased use of SMS and MMS as marketing tools by several companies leads to an interesting challenge about recommender systems apply on them. The simulation of cake ordering m-commerce system was to conduct a B2C commerce which accompanies with the supporting features SMS and MMS. The researchers attempted to use the value propositions of m-commerce especially personalization. The intelligent personalization program using item-based collaborative filtering recommendation helps customers find items they want to buy from the business. Recommender systems benefit customers by enabling them to find items they like. The researchers hope that this interesting marketing tool and the new technologies of mobile phone will enable business can reach the target customers.

REFERENCES