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Personalization of Brick-and-Mortar Retail Stores

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The outpaced growth of online channel sales over the traditional retail sales is a result from superior shopping convenience that online stores offer to their customers. One major source of online shopping convenience is a personalized store that reduces customer's shopping time. Personalization of an online store is accomplished by using various in-store shopping behavior data that the Internet and Web Technology provides. Brick-and-mortar retailers have not been able to make this type of data available for their stores until now. However, RFID technology has now opened a new possibility to personalization of traditional retail stores. In this paper, we propose BRIMPS (BRIck-and-Mortar Personalization System) as a system that brick-and-mortar retailers may use to personalize their business and become more competitive against online retailers.

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1. Introduction

1.1 Problem Statement and Motivation

It has been a little over a decade since Amazon launched its online bookstore. The relative importance of the Internet as an additional retail channel has increased since then. Now Amazon became the world's largest online only retailer (i. e. e-tailer or pure-click) selling many different types of goods including books, toys, sporting merchandise, apparels, and many others. Online retail sale in America is expected to increase by 18 percent during 2007. It is much faster than 4～5% increase of total retail during the same period (NRF report, 2007). We have observed this outpaced growth of online sales for over a decade and expect its continuation for some time in the future. Such success of e-tailers casts a shadow of significant erosion in conventional retail

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(i. e. brick-and-mortar) business. Without any doubt, e-tailing appears to overcome fairly well its inherent disadvantages of not being able to provide in-store shopping experience in segments of customers who value shopping convenience higher than other factors. Although current market share of e-tailing reaches far below that of the brick-and-mortar yet (Retail Forward Newsletter, 2004), the brick-and-mortar sector needs to make a significant innovation effort to at least slow down the speed of its market share erosion.

The success of e-tailing comes from various advantages that Internet and Web technology offers. One key advantage of e-tailing over brick-and-mortar is the ability of monitoring consumer's purchase behavior. Let's suppose a customer walks into a conventional store, looks for items, and leaves the store. The owner will never know about the visit, because he did not make any purchase. However, the Internet-based online store can capture data on all aspects of shopper's behavior in a cost effective manner even in cases of no purchase. For example, it records the start- and end-time of visit, pages and path of visit, duration spent on specific pages, and so forth. E-tailers analyze the captured data on shopping behavior to obtain actionable information, and use it to design and launch various programs for enhancing customer's shopping convenience, which is the biggest advantage to online shopping (AuctionBytes-Update Newsletter, 2008). One example is personalization designed to help customer to search products more easily thereby save shopping time: these two are main elements of shopping convenience (Nielsen Online Monthly News, 2007). Personalization tailors Web pages to individual customer's characteristics or preferences to make a Web site easier to use, create a one-to-one experience, increase customer loyalty, save customer time, and so on (Riecken, 2000).

While e-tailers greatly leverage the advantages of the digital channel, brick-and-mortar players were not able to do anything beyond the second wave of marketing intelligence (Burke, 2005) such as analyzing individual purchases using frequent shopper/loyalty programs due to the lack of any economic means to track shopper's in-store purchase behavior. However, now the third wave tools for monitoring shopper's in-store behavior start to become available to brick-and-mortar retailers. Recently, we see more and more of major retail and IT firms such as Metro Group, Microsoft, IBM, and others, team together to improve customers' shopping experience in brick-and-mortar stores using the latest information technology (IBM Press, 2008; PressPass-Information for Journalists, 2008).

In this paper, we propose BRIMPS (BRIck-and-Mortar Personalization System) as a brick-and-mortar retail business personalization system. The objective of the system is to raise the competitiveness of brick-and-mortar retailers by personalizing their business using the latest information technology including the most recent RFID technology. In the subsequent sections, we will introduce the main issues concerning personalization of brick-and-mortar stores and give an overview of related work in this research area. Afterwards, we will discuss various aspects of BRIMPS in the order of required infrastructure, typical operation scenario, major build-

ing blocks along with their functionalities, and expected benefits.

1.2 Personalization of Brick-and-Mortar

One most significantly differentiating aspect of e-tailing compared to conventional retailing is personalization. It is the process of using customer's information to deliver a content matching to individual customer's characteristics or preferences (Murthi and Sarkar, 2002). Personalized e-tailing systems recognize the customer at log in time and personalize their Web pages of the online store. Each and every Web page of an online store is equivalent to a zone in a brick-and-mortar store. Personalization system selects the products that logged-in shopper is likely to prefer based on previously collected customer's preference information, brings digital images of those products, and fills the Web pages. In other words, it is like each and every logged-in shopper visits a differently arranged (i. e. personalized) store displaying only the products of his preference. Using this technique, Amazon, widely known as a pronoun for personalization, now presents a personalized store to millions of shoppers and became one of the earth's most customer-centric companies (Info World, 2000). Personalization increases shopping convenience by reducing shopper's time and frustration involved in searching for right products. Besides, personalization attracts more and more customers to the Web site by making customers' shopping experience more pleasant and convenient.

As discussed, personalization of online stores is accomplished by bringing only the products that shopper is likely to prefer to the Web pages. Filling the Web pages with images of different products can easily be done. However, in a brick-and-mortar retail setting, filling a zone with a different set of products for each and every shopper would be impossible. That is why personalization has been thought as an inconceivable alternative for brick-and-mortar retailers. For this reason, in a conventional retail setting, store floor layout decision is targeted rather to overall customers than to individual ones. The floor layout decision, once implemented, lasts for some time after, because frequent layout changes not only incur significant cost but also confuse shoppers.

However, personalization in a conventional retail setting can be accomplished in a totally opposite way: rather by guiding a shopper to the zones in a store where the products of his interest are located than by bringing those products to where a shopper stands at. To accomplish this type of personalization, we need information on shopper's shopping list, information on floor layout of a store, and lastly but most critically real-time information on shopper's geographical location within a store. Thanks to the RFID technology, shopper's location information can now be captured in real time at reasonable cost and used for personalization of brick-and-mortar retail business. In the following sections, we will present in-depth discussions on how the BRIMPS supports personalization of brick-and-mortar retail business. It is noteworthy that once the basic functionality for brick-and-mortar personalization-shopping list preparation, shopper recog-

nition, and navigation support-is accomplished, various kinds of additional context-based shopping assistance service, such as on-spot promotional program alert service, can easily be provided. BRIMPS leaves the door wide open for brick-and-mortar retailers to expand the horizons of their personalized services to customers by making additional data available.

2. Related Work

Although the use of RFID and/or mobile technologies in retail scenarios has been intensively researched in recent years, no holistic system for personalization of the brick-and-mortar has been presented so far. The contributions usually focus on technological or economic aspects while the personalization issue takes a back seat.

The contribution by Decker et al.(2003) is one of the first papers to deal with the application of RFID at the point of sale. The authors propose a smart shelf as a solution to track simple actions of shoppers and they discuss potential benefits of data mining, store management, and recommender systems. Several papers (Kourouthanassis and Giaglis, 2005; Kalyanam et al., 2006; Sackmann et al., 2006) deal with the concept of the RFID based Personal Shopping Assistant (PSA) system.

Schloter and Aghajan (2005) illustrate a retail store application based on RFID technology. In their approach the movement of the participating shoppers is used to facilitate the customer relationship management. The authors describe technological and economic issues by means of a first prototype implementation. Buser (2007) presents a RFID based recommender system in grocery stores. The author focuses on the economic aspects of the proposed application distinguishing between the costs and benefits for the retailer and the shopper. The technical architecture of the system is only touched upon. His most recent work (Buser, 2008) compares the architecture between online stores and RFID enabled brick-and-mortar retail stores. As Buser states: “The advantages of both environments should be taken together and a new shopping experience with a huge data background leading to advantages for both, the seller and the buyer, should be built.” Moreover, the author identifies two new RFID applications, the expiration-date dependant price and context-based recommendations.

Cinicioglu et al.(2007) extend the functionality by introducing a RFID based application for dynamic advertising in retail stores. The proposed application builds on real time information about products which the shopper puts in the cart during the shopping process. Based on this data, collaborative filtering is used for the selection of advertised products which are complementary to the ones already in the cart.

Keegan and O’Hare (2003) implemented the Easishop system that helps a customer to find a nearby retailer who can match her budget constraint for an item that she desires to purchase. The shopping agent running on PDA initiates the negotiation with the store agent representing the stores detected using the Bluetooth connection. However, the context information used by Easishop is limited to location information.

The personalization of offline stores needs the context-based recommendation which provides a target customer with personal recommendations by reasoning his/her contextual profile acquired through the context-aware computing technology. Kwon et al.(2003; 2008; 2009) suggested a variety of context-based recommendation techniques which include agent technology, associative theory, concept lattices, etc.

3. Overview of BRIMPS

<Figure 1> illustrates the concept of BRIMPS. It detects the movements of shoppers and products in the store in real time and provides various information supports to shoppers for better shopping experience. Information technologies used for BRIPMS have already been or currently being validated, evaluated in various research projects carried out by major retailers such as the Extra Future Store of the METRO Group (NRF, 2007) in Germany. Besides, some of those have already been developed to some extent in various empirical studies (Roussos et al., 2002; Strüker and Sackmann, 2004; Kourouthanassis et al., 2007). In this section, we discuss the infrastructure and the typical operation scenario of BRIMPS.

The process innovation opportunity of BRIMPS comes from the fact that it bridges the gap between the data world and the physical world by using the information technology. It puts the two worlds in a closed loop by constantly capturing in-store movement data of shoppers and products in real time, renewing the context such as the shopper's location, generating personalized and context-based recommendations, and delivering them in the form of various information supports thereby helping shoppers to make next moves in shopping. To accomplish this, BRIMPS needs three major components in its in-store infrastructure, some of which are being tested in different pilot projects carried out by research groups or large retailers.

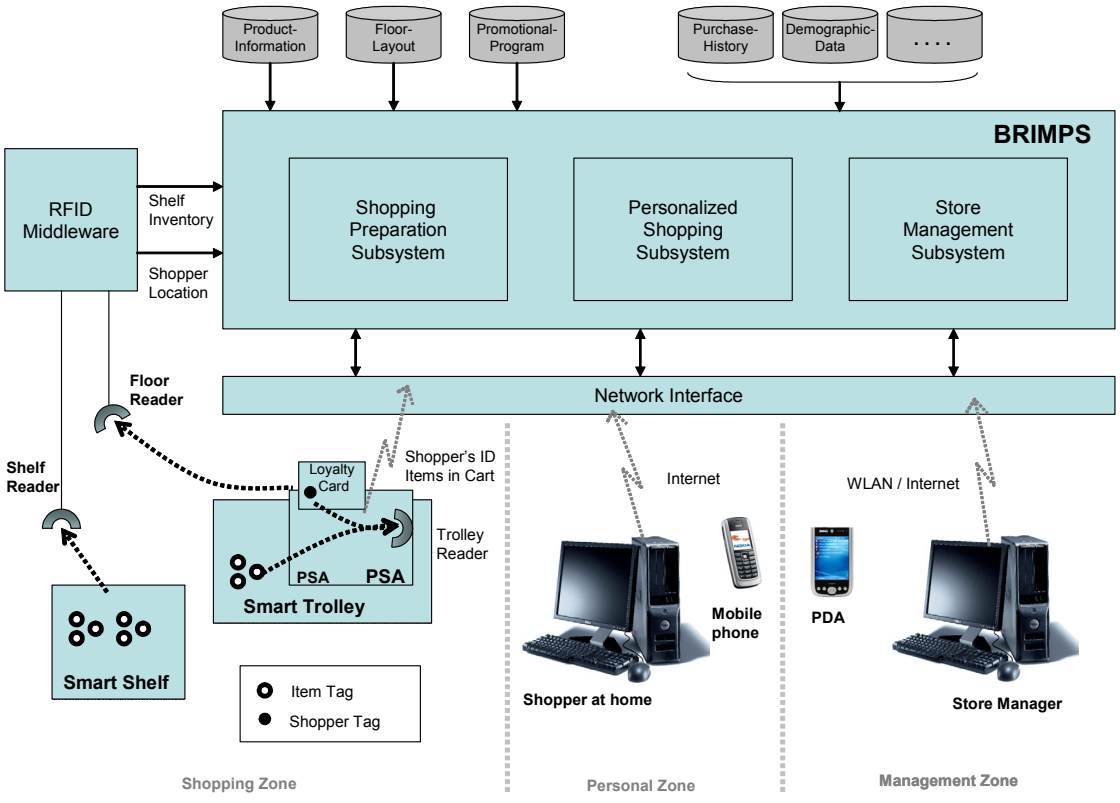
Firstly, we need a network of RFID readers in the store. The RFID reader network consists of two kinds of stationary readers: one kind being comprised of readers on the floor (i.e. floor readers) sensing shoppers' movement to calculate exact location of each and every shopper, and the other kind being comprised of readers attached to the shelves (i.e. shelf readers) sensing the in-and-out movement of products by reading the tags on products. The floor readers need to be spread out throughout the store, so that shopper's exact location can be calculated from the read data. The shelf equipped with RFID readers is called a smart shelf, because it, with the item-level tagging, provides data needed to monitor inventories in each and every shelf in the store.

Secondly, we need a WLAN network to be used as an in-store communication channel between shoppers and BRIMPS. WLAN access points needs to be installed throughout the store for proper in-store WLAN coverage. Shopper, while shopping, needs to carry some kind of mobile peripheral (to be elaborated later) that runs a WLAN client so that he can interact with the system for various information supports.

Lastly, we need a certain moving object that BRIMPS can associate with each and every shopper.

Floor readers sense the shopper's movement by reading the RFID tag attached to the object. Moving object and previously mentioned mobile peripheral device requirements can be satisfied by introducing a smart trolley which is a shopping cart equipped with a mobile tablet PC and a RFID tag. With an additional RFID reader affixed to the PC, the smart trolley can also send shopping progress data to BRIMPS via WLAN by recognizing tagged products every time they are put into or taken out from the shopping cart. BRIMPS provides many types of personalized shopping assistance to shoppers via the mobile PC which is called a Personal Shopping Assistant (PSA). For personalized assistance, PSA identifies the shopper by reading the RFID tag on his loyalty card at login time. At this time, the shopper ID is passed to BRIMPS via WLAN.

<Figure 1> illustrates all these major infrastructural components that BRIMPS needs. However, it is noteworthy that shelf readers may also function as floor readers and sense the shopper's movement; WLAN triangulation technique can be an alternative for shopper localization; and PDA or Smartphone can also be used as a PSA. Additionally, monitoring the contents of the shopping cart can be accomplished by affixing a barcode scanner instead of a



<Figure 1> Operating Environment of BRIMPS

RFID reader to the PSA with shopper's effort of scanning before placing them in the cart.

4. Components of BRIMPS

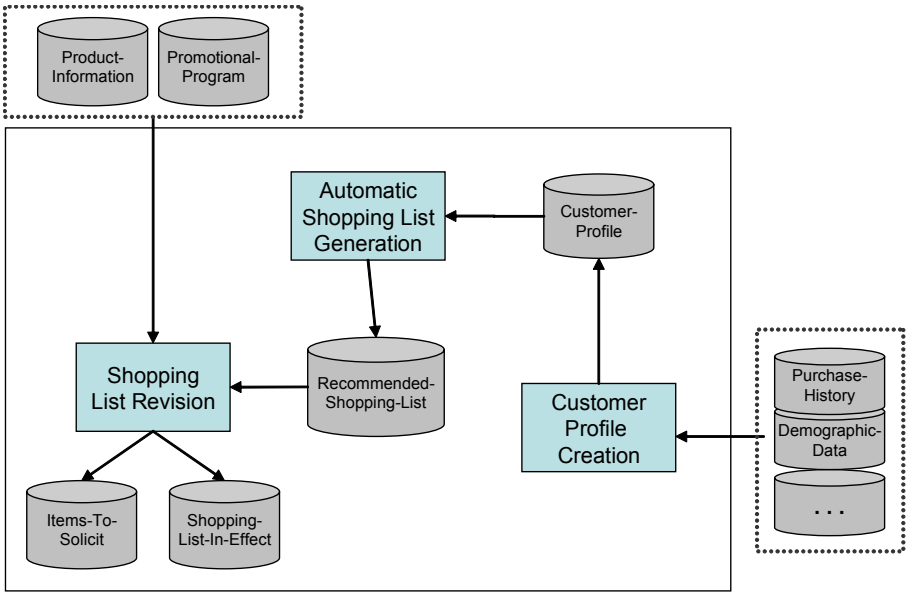
There are three subsystems in BRIPMS: Shopping-Preparation (SP), Personalized-Shopping (PS), and Store Management (SM) subsystems. These subsystems cooperate to accomplish the personalization of brick-and-mortar stores which is the main objective of BRIMPS. SP and PS support the functionalities that BRIMPS needs prior to and during shopping respectively. SM delivers various management information to store manages using the purchasing behavior data in good resolution captured by BRIMPS. In this section, we discuss the major building blocks of BRIMPS in detail along with their functionalities.

4.1 Shopping-Preparation (SP) Subsystem

SP is responsible for helping customers to prepare their shopping lists prior to shopping. As illustrated in <Figure 2>, SP is comprised of three modules: Customer Profile Creation, Automatic Shopping List Generation, and Shopping List Approval Modules. Detail discussion on individual modules follows.

4.1.1 Customer Profile Creation Module

This module reads all types of already available information about customers' preference to create the customer profile for the Automatic Shopping List Generation Module. The profile needs to con-



<Figure 2> Shopping Preparation Subsystem

tain sufficient information related to likes and dislikes of each and every customer. What types of information we need as input to this module largely depends on what type of goods BRIMPS recommends and what level of assistance it intends to provide. Some of the information that can be considered includes, though not exhaustive, purchase history, demographic data, dislike list, watch-out list for health reasons, price preference, and so forth.

4.1.2 Automatic Shopping List Generation Module

This module uses the customer profile information to generate a list of items that a customer is likely to purchase in his next shopping trip. BRIMPS presents the generated list for a review to a customer as the first draft of his shopping list. Content-based and collaborative filtering methods are most widely known recommendation techniques. However, there are many different recommendation techniques that have been developed in recent years including the hybrid techniques combining multiple recommendation techniques. Selection of recommendation techniques, although it is beyond the scope of this article, should depend on the objects for recommendation. For example, collaborative filtering technique never recommends previously purchased items. This may be fine in the case of durable goods, but not in the case of the goods to be purchased on a repeated base such as foods.

4.1.3 Shopping List Approval Module

This module allows a customer to review the Recommended-Shopping-List and finalize his shopping list using either a PC at home via internet or the PSA in the store prior to shopping. At this time, customer can refine his shopping list with the help of various BRIMPS-provided search tools for additional information on products, promotional programs, and so on. During the session, customer approves his shopping list by repeating the addition of new items to and deletions of existing items from the list. The approved list then becomes the Shopping-List-In-Effect and BRIMPS uses the list as the base for formulating personalized shopping assistance to the shopper throughout shopping. The items that were in Recommended-Shopping-List but did not make to the Shopping-List-In-Effect are recorded in an Items-To-Solicit list for later solicitation by the Context-Based Support Module.

4.2 Personalized-Shopping (PS) Subsystem

PS is responsible for helping shoppers to carry out their shopping pleasantly. As illustrated in <Figure 3>, SP is comprised of five modules: Shopper Registration, Navigation Support, Context-Based Support, Shopping Progress Update, and Shelf Inventory Update Modules. Detail discussion on individual modules follows.

4.2.1 Shopper Registration Module

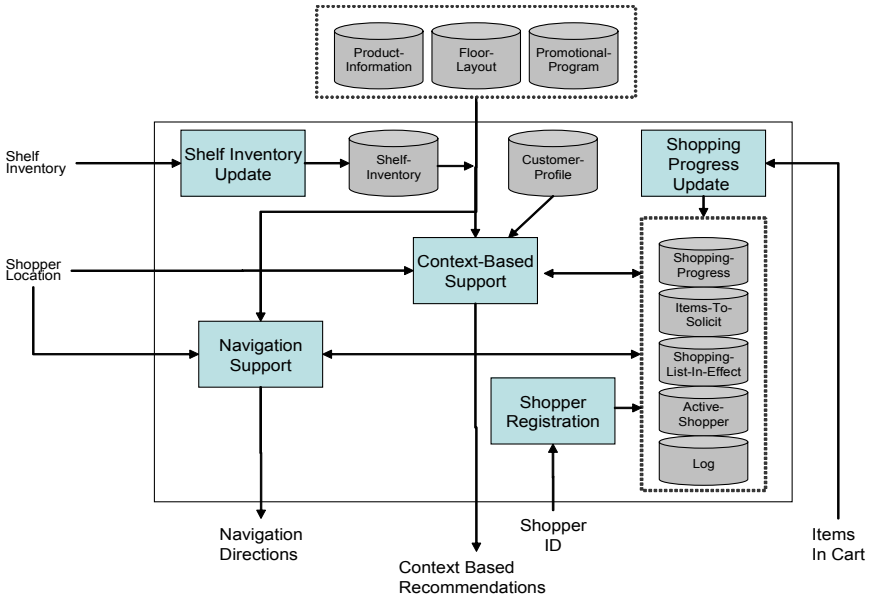
The customer who wants to take an advantage of the personalized assistance from BRIMPS needs to log into the system by sticking his loyalty card into the PSA. At this time Shopper Registration Module recognizes the customer, registers the cus-

tomer as an active shopper in the system, and brings his shopping list to the PSA for his final approval. If the shopper has not approved his shopping list yet, this module reminds him to do so. The shopper may do the shopping without the shopping list as well. In such a case, he still can take an advantage of the personalized shopping assistance from Context-Based Support Module. However, no assistance from Navigation Module becomes available. When shopping is done shopper removes his loyalty card from PSA. Upon removal, this module registers the customer out of the active shopper list so that BRIMPS can terminate all shopping assistances for the customer.

4.2.2 Navigation Support Module

This module is the most important component in BRIMPS. It eliminates the major obstacle toward the personalization of a brick-and-mortar store. It provides in-store navigation directions along the optimal path that a shopper can follow to move from one point to the other in the store bypassing all the products that he is not interested in. This is exactly like what's happening in the personalized online store: shopper clicks the mouse to move from one page to the other directly without going through all unwanted products. Optimal path saves shopping time for shoppers because it is the shortest path that connects the entrance, all the products that he plans to purchase, and the checkout counter (Hui et al., 2007).

To provide this important functionality, this module uses the shopper's current position passed by floor readers and the store's floor layout informa-



<Figure 3> Personalized Shopping Subsystem

tion. It first forms a graph with the nodes and edges respectively representing the zones where shopper needs to visit and the paths between those zones. Then it applies the algorithms such as Dijkstra's to calculate the optimal shopping path starting from his current position. The feasibility of such algorithms for brick-and-mortar-store settings has been proved (Hui et al., 2007). Once the optimal path is calculated, the navigation direction is displayed on the PSA along with the store map including the shopper's current position and the next stop on the path highlighted.

There are some events that results in changes to the graph that is used for optimal path calculation. Shopper's movement away from the path introduces a new node of his current position to the graph. Addition of a new item to the shopping list and deletion of an existing one from the list possibly results in changes to the graph as well. This module detects such context changes and recalculates the optimal path using the altered graph.

This module may closely monitor shopper's movement in the store and infer a user's plan or goal of shopping (e.g. pleasure shopping, special occasion shopping, etc.) by using a plan recognition technique (Schneider, 2003). The inference result can then be recorded to the Active-Shopper list and made available to the Context-Based Support Module so that the module can accordingly adjust the assistance level such as the frequency of recommendation delivery.

This module also detects out-of-stock situation and labels the item on the Shopping-List-In-Effect list as 'not available' so that Context-Based Support Module can handle the item accordingly. Another important function of this module is to record shoppers' movement data passed by floor readers to the Log file. The data is a crucial part for enhanced marketing intelligence brick-and-mortar retailers can obtain by implementing the BRIMPS.

4.2.3 Context-Based Support Module

The objective of this module is to detect the changes in the context and deliver to the shopper with various information supports reflecting the most current context where the shopper is situated in so that the shopper can make next moves based on the new context. Typical context changes, though not exhaustive, include the changes in shopper's in-store location, changes in his shopping progress, and others. The simplest form of the context-based support will be just informing the shopper of the detected context changes as they are. For example, it might simply display current time, elapsed shopping time, number of items put into the trolley so far, etc. This type of context-based supports can be categorized as informational which means that no specific response from the shopper is necessary. However, there are some cases when specific response from a shopper is desired. For example, when BRIMPS finds an item labeled as 'not available' on the shopping list, it suggests another item as a substitute. In this case, shopper's response is necessary to continue the service whether shopper accepts the suggestion or not. If shopper does accept the suggestion, this module adds the substitute to the Shopping-List-In-Effect list. Otherwise, this module discards the item labeled as 'not available'

from the list.

Another example of the context-based support is to inform a shopper of the currently effective promotional program for an item that shopper is likely to prefer located in the isle that he is just passing by. It also solicits a shopper for items on an Items-To-Solicit list at proper time during shopping. It makes suggestions on additional products based on what he has already put into the trolley. A time based price scheme (Strüker and Sackmann, 2004) may trigger another type of context change. Needless to say, all these context-based recommendations or suggestions for a shopper should agree with his customer profile. We just have cited a few possible context-based supports. However, context-based support of BRIMPS offers the great the opportunities to the brick-and-mortar retailers for target marketing and on-spot advertisement. They can use BRIMPS to detect all kinds of useful context changes and widen the horizon of their personalized shopping assistances to their customers.

As discussed, a customer without shopping list cannot take an advantage of the navigation support from BRIMPS. However, he still can take an advantage of the context-based support. A customer without any profile information in BRIMPS still can take an advantage of the context-based support, but the context changes for evaluation is limited to the customer's actual behavior inside the store such as the path taken, products put into the cart, and so on.

Lastly, this module also records the data about prompts made by this module and shopper's responses to those prompts. The recorded data in the Log file is to be used by SM Subsystem to assist store managers.

4.2.4 Shopping Progress Update Module

This module receives the data about the items in the cart, which is captured by the trolley reader, and updates the Shopping-Progress file accordingly. This update renews the context and triggers another context review. This module also records product movement data to the Log file whenever the content in the smart trolley changes (Hui et al., 2007). The data is equivalent to the Web log data recorded when the content of shopping basket is changed in the online store.

4.2.5 Shelf Inventory Update Module

This module updates the Shelf-Inventory file using the shelf inventory data passed by the smart shelves. This is necessary for Navigation Support Module to detect the stock-out items and label them accordingly for later handling by Context-Based Support Module.

4.3 Store Management (SM) Subsystem

The objective of SM is to assist brick-and-mortar store managers in daily operation and provide them with the better business intelligence required for planning. A few examples are: BRIMPS automatically monitors the shelf inventories thereby eliminates the need for in-store physical inventories; issues the refill requests to avoid out-of-stock situations; provides various statistical data on shopper's behavior; provides real-time prediction on checkout counter queue-length by analyzing shop-

ping progress and shopping list information of shoppers in the store, and provides clues for floor layout optimization. Besides, many kinds of management information can be produced using the shopping behavior data newly became available by BRIMPS. Although further elaboration on supports store managers is not necessary, it is worth to stress that the RFID technology captured data offers the brick-and-mortar retailers the new and great opportunity toward the third wave of marketing intelligence (Burke, 2005).

5. Service Scenario

5.1 Shopping Scenario

The following scenario demonstrates John's typical shopping trip to a personalized brick-and-mortar store with BRIMPS.

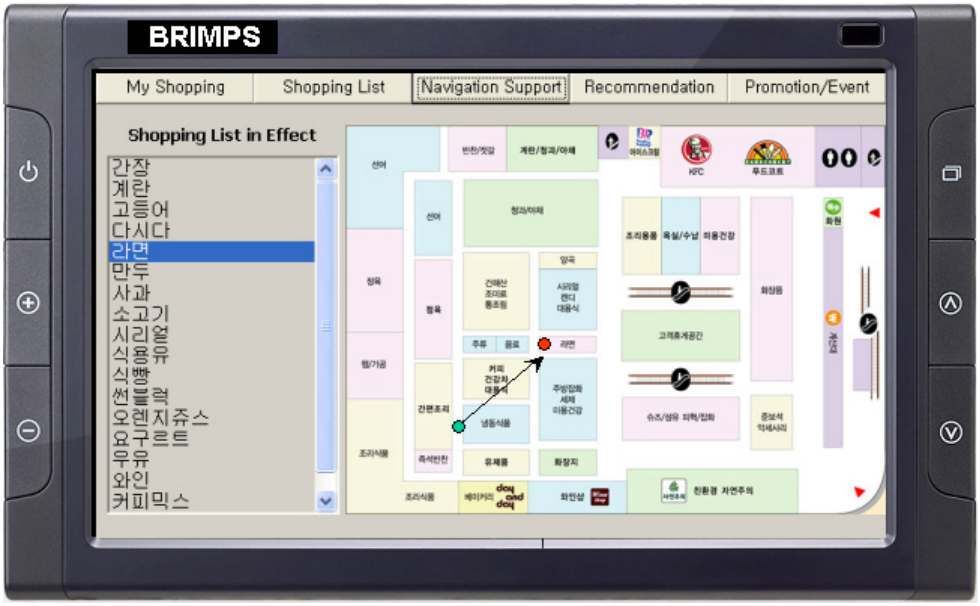
1. The BRIMPS automatically generates a suggested list of shopping items for each and every shopper based on customer's profile information including such as past purchase records, demographic data, and so forth. Prior to the shopping trip, John may use his PC connected to the Internet at home to review or revise his shopping list recommended by BRIMPS.
2. Upon his arrival at the store, John grabs a smart trolley and logs on BRIMPS by sticking his loyalty card into the PSA. Then, BRMPS recognizes that the shopper is John and displays John's personalized shopping list. John may further revise his shopping list at this time if necessary. When ready, John walks into the floor to start shopping.
3. BRIMPS uses his shopping list and store layout information to calculate his optimal traveling path for shopping through the store. John navigates the store by following the directions that BRIMPS displays on PSA (see <Figure 4>). Upon arrival at the stops, John should easily find items on his shopping list and put them in the trolley. Whenever John puts an item into or takes an item from the cart, his shopping progress such as total purchase amount is displayed on the PSA.
4. During shopping, BRIMPS informs John of a promotional program for an item, which John is likely to prefer, located in the isle he is just about to pass by (see <Figure 5>). John requests more information on the item using the touch screen of PSA, and decided not to pursue further.
5. BRIMPS informs that the item X on John's shopping list just went out of stock and suggests an item Y as a substitute. Upon John's refusal, BRIMPS recalculates the shopping path to exclude the item X from his shopping list.
6. From time to time, John may get off from his optimal path to check out other items. BRIMPS, in this case, recalculates his shopping path and delivers revised navigation directions. John repeats these steps until no more items are left in his shopping list.

7. When shopping is done, BRIMPS guides John to the cashier. After the check out, John logs out of BRIMPS by removing his loyalty card from the PSA.

5.2 Benefits

Customers can save his time in shopping list preparation by using shopping list preparation aids. The navigation support offers the most efficient shopping path for shopping thereby saves customer's shopping time. BRIMPS also reduces customer's time required for various information chasing by providing search tools for products, promotion programs, and so on. Shopping convenience is greatly improved by various on-spot information support such as promotion alert service. Overall, BRIMPS makes the customer's shopping experience pleasant and enjoyable.

On the other hand, BRIMPS provides very rich management information thanks to the shopping behavior data collected using the RFID technology. Management also gets an additional channel of interaction with shopping customers. Using this channel, management is able to validate various process transformation ideas on a pilot basis prior to the full scale launching. Most importantly, the availability of shopping behavior data with an additional dimension of time enables the store managers to take scientific approaches to management. For example, store managers can analyze the effect of the proposed floor layout revision using the simulation technique. With the shopper's shopping behavior data, evaluation of the new floor layout will be equivalent to a performance evaluation of the floor plan with the data as a workload. In other words, the



<Figure 4> A User Interface for Personalized Navigation Support

<Figure 5> A User Interface for Personalized Promotion

effects of the proposed revision plan can be evaluated through the simulation. At the same time, the performance analysis using the simulation technique would provide many meaningful clues and incites to store managers for potential improvements.

We expect brick-and-mortar retailers will experience higher level of customer satisfaction because of the personalized shopping assistance provided by BRIMPS. That will lead to higher customer loyalty, which eventually leads to higher ROI. Customer's shopping time saving means the less crowding on the floor, which leads to higher floor utilization, which is equivalent to potentially higher revenue per square feet. And the retailer would also observe that the organization slowly but continuously turns into a customer-oriented one.

One most significant benefit of having BRIMPS over all is to own shopping behavior data of each and every customer for any time period. This file provides a great opportunity for future improvement to their shopping process. With this data and BRIMPS, the brick-and-mortar retailers can further personalize their business and take advantage of their inherent advantage in meeting feel-before-purchase desire of customers to significantly strengthen their competitiveness in the market.

6. Conclusion

So far, e-tailers have been quite successful in drawing customers from traditional retailers by continuously improving shopping convenience in their Web sites. Shoppers who are willing to trade their feel-before-purchase desire for additional conven-

ience have switched to online retailers for shopping. Furthermore, e-tailers have made various efforts such as including multi-angle pictures of products in their Web pages to meet though partially the feel-before-purchase desire of online shoppers. However, current technology undoubtedly has a limit in satisfying the desire. The limit comes from the lack of capability of current information technology in capturing the human senses of feel, taste, and smell, replicating, and redelivering to human. The limit is expected to remain until the foreseeable future as an insurmountable disadvantage to online retailers since their channel employs the information technology as the foundational element of its infrastructure.

Although, brick-and-mortar retailers undoubtedly have inherent advantages in meeting the feel-before-purchase desire of shoppers, they have been defenseless against e-tailers in providing shopping convenience because of the inferiority of their distribution channel in that regards until now. However, we now have good news to brick-and-mortar retailers: the RFID technology that bridges the gap between the physical world and the world of data. In this paper, we presented a system called BRIMPS that brick-and-mortar retailers may use to personalize their business. The system, using the RFID technology, senses the movement of shoppers and products in a retail store and responds to shoppers with personalized recommendations and useful information reflecting the most current context they are situated in. With the BRIMPS, brick-and-mortar retailers can widen the horizon of their customer service toward much more improved level of personalization and score a small win over e-tailers.

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Abstract

오프라인 상점의 개인화

김찬영* · 조윤호**

온라인 시장의 매출 성장률은 오프라인 시장을 크게 앞지르고 있으며 그 원인은 상점의 개인화를 통한 쇼핑 시간 절약, 상대적 편이성으로 알려져 있다. 온라인 상점의 개인화는 인터넷, 웹 테크놀로지가 제공하는 고객 쇼핑 행태에 관한 다양하고 상세한 고객의 쇼핑 데이터의 사용으로 가능하다. 과거에는 오프라인 상점에게 이와 같은 데이터가 제공될 수 없었으나, 최근 확산되고 있는 RFID 기술은 오프라인 상점에게 상점의 개인화라는 새로운 기회와 가능성을 제공한다. 본 논문에서는 오프라인 상점이 온라인 상점과의 상대적 경쟁력 향상을 위하여 그들 상점의 개인화에 사용할 수 있는 *BRIMPS(BRIck-and-Mortar Personalization System)* 시스템을 제안한다.

Keywords : 개인화, RFID, 상황기반추천, 매장위치안내, 오프라인상점

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현재 동양공업전문대학 인터넷비즈니스과 교수로 재직 중이다. 서울대학교 전자공학과를 졸업하고, University of Chicago에서 MBA를, KAIST 경영공학과에서 박사학위를 취득하였으며, AT&T Bell 연구소, 앤더슨 컨설팅 등에서 근무하였다. 주 연구분야는 Recommender System, e-Business, m-Business 등이며, IEEE Intelligent Systems, Lecture Notes in Computer Science등에 논문을 게재하였다.

조윤호

현재 국민대학교 경영대학 경영학부 부교수로 재직 중이다. 서울대학교 계산통계학과(전산학전공)를 졸업하고, KAIST 경영정보공학과에서 석사, KAIST 경영공학과에서 박사학위를 취득하였으며, LG전자(주)에서 6년간 주임연구원으로 재직하였다. 주 연구분야는 Recommender System, Mobile Business, CRM, Data mining 등이며, IEEE Intelligent Systems, Electronic Commerce Research and Applications, Computers and Industrial Engineering, Expert Systems with Applications, International Journal of Internet and Enterprise Management 등에 논문을 게재하였다.