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Smart Cart to Recognize Objects Based on User Intention

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Abstract: Shopping in the real world is becoming an increasingly interactive experience as stores integrate various technologies to support shoppers. We present Smart cart a sensible mobile grocery aid which supports customers in the shopping process. We conducted a user study to assist the design of smart shopping trolley. Through which are explored preferable features to be incorporated in a mobile grocery aid we describe the study and its results the design principles and design of massive the features that are supported by smart cart and the functionalities that are to be integrated into smart Shopping. We also describe the technical challenge we came across during our development efforts. The aim of the system is to support shopping in supermarket through acquiring user attention. Thus ,the interactive trolley guides and directs shoppers in the handling and finding of groceries than traditional trolley shoppers by exhibiting a more uniform behaviour in terms of product sequence collection and easier for shoppers to find products and shorter distance.

Keywords: Mobile and Pervasive Technologies, Smart Cart, Sensor, Supermarket.

I. INTRODUCTION

Shopping in the real world is likely to involve both handling of real world objects or smart objects and at the same time mobile technologies for enhancing the experience. Products placement and exposure is important for supermarket shopping and promoting products on a trolley screen raises concerns example what products should stores show on the display, when should these products be displayed, and where in the store should certain products be displayed we describe the design and evaluation of a prototype for enhancing the shopping experience in supermarkets by actively acquiring and maintaining the user's attention.

Supermarkets is becoming an increasingly interactive experience. Concept stores like the metro groups future store have started using radio frequency identification tags to streamline supply chain as part of a check out free store concept. Other stores have integrated self-checkout points to speed up the paying process while others integrate barcode scanners where shoppers can get information about products. Shopping trolleys almost every one of shops for groceries on a regular and frequent basis and thus grocery shopping may be regarded as one of the most fundamental activities in the day-to-day life. The basic nature of grocery shopping with a huge business potential makes it an interesting domain for innovating pervasive and mobile computing technologies. Before going for shopping, customers create either a written or a mental shopping list. Consumer studies have shown that between 50% and 75% of customers create a Witten shopping list for major shopping visits and the majority of remaining customers create a mental shopping list. Shopping list is used as external memory aids, a tool for budgeting and a guide to plan the visit to the store. However shopping list are not rigid plans. In fact, customer purchase two to three times more items than what are included on their shopping list. Accordingly, retailing also provides space for exploring alternatives and potentially relevant and interesting items.

Massive a sensible mobile grocery aid that supports customers during all stages of the grocery shopping process. In a view to support existing shopping practices massive has been designed around a shopping list model where shopping lists has been created by customers using free from natural language massive also supports collaborative list formation by allowing customers to share shopping lists. For instance, shopping lists can be shared among shoppers when planning for a joint social event massive is constructed in collaboration with a large national supermarkets that has been equipped with additional Wi-Fi access points to enable positioning and from which we receive have got shopping basket data to support personalization. To find out the functionalities to be incorporated into massive, we performed a survey study in a large national supermarket in which we explored the preference of customers for potential features in mobile grocery aid. We describe the study ant its results, the design and current features of massive, the functionalities that we are currently working on and the technical challenges we have faced during our development efforts.

II. RELATED WORK

The design of smart shopping cart consisted of four main elements which are hardware integration, software interface, wireless communication and network database.

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The goal for each element is to get the most accurate and best performance to be implemented in the project. There are two different designs that can be used to accomplish the goal of this project. The two designs are similar with the exception of the main computer being used. Our group spent a lot of time researching on both designs before choosing any one design for this project. The two designs that meet the requirements of this project.

A. *Wireless Communication*

The design of smart shopping cart consisted of four main elements which are hardware integration, software interface, wireless communication and network database. The goal for each element is to get the most accurate and best performance to be implemented in the project. This design includes a microprocessor which can be used with an LCD, a wireless card, barcode reader, and a portable battery. The barcode reader will be used to scan the items, and the Wi-Fi card will be used to connect wirelessly to the store's database. The device will be detachable, so that it can be used from one shopping cart to another. This design also includes external speakers which will guide the customer with voice prompt to select their option on the LCD screen. The number of sensors including required wiring constantly increases, adequate measures are necessary to keep efforts small in data acquisition. Concerning the cost and complexity of a data acquisition system, a wireless sensor network seems to be a conveniend option. For this function, wireless network standard ZigBee is appropriate. Based on protocol IEEE 802.15.4, ZigBee has been developed for low-cost applications with little amount of data in wireless local area networks. Development of IEEE 802.15.4 matched wireless sensor network (WSN) the sensor to acquire and internal storing data alternatingly. A mobile network is detected in proximity the node will automatic send data. Start time as well as the time breaks for the sizes can easily automatic over the network system. Option to sensor data can be deliver on demand. Reaming node idle state the decrease power consumption of power down mode. The system is based on a microcontroller coupled to an RF-transceiver.

An RFID reader was also installed on the shopping cart to record product related events. Unlike barcode which is the commonly used technology for product identification today and requires significant involvement on the part of the user, RFID offers several advantages (a) it senses events and captures related data in a way that does not require line of sight visibility between the tag and the reader, (b) it is more resistant to hostile environments and can survive the effects of excessive levels of dust and moisture, (c) it can store more information and thus it may be programmed to hold a unique product identification number, and finally (d) it provides anti-theft capabilities to support electronic article surveillance (EAS) that can verify that cart contents have been paid for on exit.

B. *PDA Access*

A PDA will be used which includes both the Bluetooth and Wi-Fi capabilities. Bluetooth technology of PDA will be used to connect to barcode readers which can wirelessly submit the barcode data to the PDA This gives the customers the freedom to move away from the shopping cart and scan the item. The same Bluetooth capabilities will be used to connect to the checkout counters where the customers can pay by credit card or cash. The Wi-Fi capabilities of PDA will be used to connect to the wireless database of the store. The following diagram illustrates how this design would look like in a store.

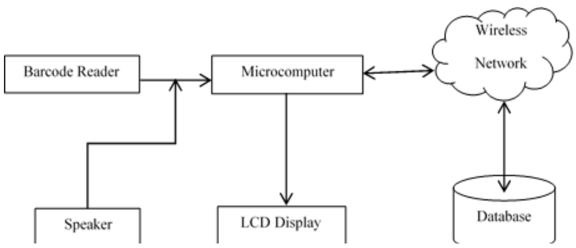

Fig. 1. *Wireless Communication*

III. SMART CART

A. *Architecture*

One of the design decisions of smart shopping was to specify and develop radio frequency identification (RFID) system. To facilitate a robust architecture it was deemed necessary to acquire early experience with RFID using one of the commercially available smart shopping designed and developed a passive RFID solution Two elements of the supermarket user interface are of particular interest that is, the shopping trolley and the sensing of product related actions for example, placement and removal of an object in the shopping trolley Improvement of the shopping experienceThe constant awareness of the total cost of the shopping trolley content which offers to the opportunity to accurately control spending during a shopping trip. Access to complete and accurate descriptions of products including price, size, ingredients, suitability for particular uses and so forth. The ability to compare the value of similar products. The provision of personalized, targeted promotions that reflect the individual consumer profile in addition to the usual generic promotions as well as the fact that consumer could access all offers available in the specific supermarket at a single interaction point. The proposed in-store navigation system especially in the case of hypermarkets where orientation is particular difficult. The smart checkout and the ability to bypass queues and reduce waiting time.

Deploying pervasive computing of retail requires the deployment of new infrastructure, primarily broadband wireless connectivity for mobile devices inside the store and electronically tagged grocery products with unique identifiers following a global classification scheme.

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Shopping Trolley aimed to study consumer perceptions of pervasive retail by designing and implementing a prototype system which would cater for the consumer on the move via mobile telephones, at home using "smart" appliances that capture consumption information and most importantly, to provide a richer shopping experience on the supermarket. The introduction of information systems in production and logistics control there are still significant inefficiencies in modern supply chains, in particular for fast moving consumer goods, which adversely affect the efficiency of retail operations.

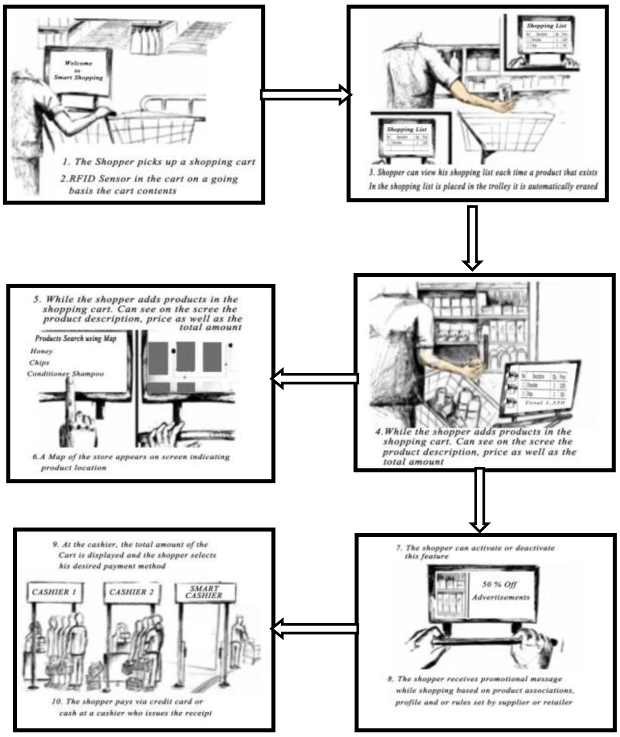

Fig. 2. *Architecture*

Upstream supply chain inefficiencies affect the relationships of all trading partners and result in high out-of-stock conditions at the point of sale, a high returns rate as well as long lead times. On the other hand, inefficiencies in the downstream direction affect negatively demand forecast accuracy which results in low on-shelf availability and thus loss of revenue despite the fact that products are available Furthermore, information-sharing ineffectiveness between trading partners reduce the accuracy of demand forecast and the scheduling of the replenishment process. A direct consequence of low demand forecast accuracy is that trading partners have to maintain increased inventory levels to address unpredictable increases which in turn result in increased logistics costs. Common practice today is forecasting consumer demand by processing historical point of sale data using decision support systems typically per store replenishment strategies are based on regional distribution center level estimates and are not driven by real-time consumer demand data. To cope with this limitation, smart shopping stores usually hold high levels of anticipatory inventory to prevent out-of-stock conditions. A direct consequence of this fact is high supply variability and thus unstable process cycle times.

The difference between true and estimated product demand is compensated through time, inventory and capacity buffers at the cost of additional capital investments. To alleviate this problem specific inventory policies such as just-in-time (JIT) and vendor-managed inventory (VMI) have been established upstream where real-time data is easier to obtain. For example, the VMI approach has proven particularly successful in improving efficiencies in the manufacturer-supplier link. With VMI the manufacturer is responsible for maintaining the supplier's inventory levels and for generating purchase orders rather than the reverse, which is the traditional practice. The same approach is being adopted in the supplier-retailer relationship through the work done at the MIT Auto-ID Center smart Shopping explored the suitability of the same technique in the retailer-consumer relationship by extending the visibility of actual end user consumption data collected by two additional sources to those currently available supermarket shelves and the home. This approach requires significant modifications on current retail information systems that work on the basis of store keeping units (SKU) rather than the individual item.

B. *Navigation Support to Shopping*

Location information in several dimensions namely between the spatial relations between products and the trolley, trolleys and shelves, products and shelves, and The items on the user's shopping list are represented with icons corresponding to those displayed in the shopping list to aid recognition and the spatial relationship to the users' current position. Finally, the map represents the user's position as a red spot. As the shopper moves with the map updates; the red spot stays in the middle of the map's display area and the map moves such that the red spot correctly depicts the shopper's location.

C. *Shortest Distances of Objects*

Querying shortest paths or shortest path distances between vertices in a large graph has important applications in many domains the goal is to find shortest routes between locations or find nearest objects such as Products algorithms to used breadth-first search (BFS), there have been many different methods for estimating the shortest path distance between two vertices in a graph based on graph embedding techniques.

Participants using the traditional shopping moved their trolley an average of 107.4 meters. This represents an average distance increase of 25.8%. This difference is statistically significant ($t(16) = -4.087$, $p < 0.001$). The shoppers using traditional tools backtracked noticeably

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more than those using navigation. The only users who backtracked were those who opted to collect items in a different order to that recommended.

IV. PREDICTION ALGORITHM

Prediction of missing items uses the concept of flagged item set trees for rule generation purpose. An item set tree, T, consists of a root and a (possibly empty) set, {T1, T2… Tk}, each element of which is an item set tree.The root is a pair [s, f(s)], where s is an item set and f(s) is a frequency.

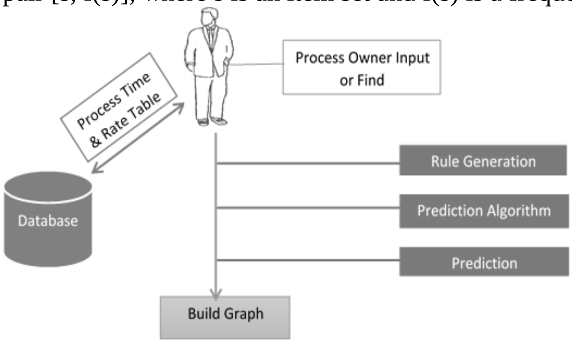

Fig. 3. *Architecture of Prediction*

If si denotes the item set associated with the root of the ith sub tree, then s is a subset of si; s not equal to si, must be satisfied for all i. The number of nodes in the tree is upper bounded by twice the number of transactions in the original database. Note that some of the item sets in tree are identical to at least one of the transactions contained in the original database, whereas others were created during the process of tree building where they came into being as common ancestors of transactions from lower levels. The authors modified the original tree building algorithm by flagging each node that is identical to at least one transaction. These are indicated by black dots. This is called flagged tree. But this methodology comes to a complex scenario when number of items increases leads to difficulty in maintaining the tree.

The Graph based algorithm proposed efficiently solves the problem of mining association rules. Both the algorithms outperform the previous algorithm by scanning the database only once and also producing few candidates. A Graph can be drawn using large item sets where each itemised is randomly numbered and stored in database in from of bit vectors. A bit vector represents a transaction where 1 represents presence of an item and 0 represents absence of an item.

V. DISCUSSION

Grocery shopping is a relatively difficult activity. The difficulty arises from various factors such as time and budget constraints, crowding, advertisements and the behaviour of shopper. To a get a good shopping experience, one avoids these difficulties by planning the shopping activity before or at the time of shopping the above said constraints of shopping activity can greatly be reduced by the use of pervasive and mobile technologies. Before going for shopping, customers create either a written or a mental shopping list. Consumer studies have shown that between 50% and 75% of customers create a Witten shopping list for major shopping visits and the majority of remaining customers create a mental shopping list. Shopping list is used as external memory aids, a tool for budgeting and a guide to plan the visit to the store.

VI. CONCLUSION

Our experience with Smart Shopping has indicated that there are several technical challenges to be met in deploying a pervasive retail system. First, technologies that capture information about interactions between physical objects are not yet mature enough for the consumer market as they are relatively costly. Even when such data becomes available the task of interpreting it is often as challenging as its registration, since no standardised classification scheme or appropriate taxonomy exists. Several efforts to create standards are underway but are still at least years away. Although in the relatively controlled environment of the smart shopping trolley project it has been possible to address this problem on a wireless basis it is hard to envision a situation where widely deployed retail services can operate without such standards. A related problem is that new systems must be integrated in existing retail infrastructures, which often operate using legacy and incompatible systems. Moreover, the deployment of retail causes significant growth in electronic transaction loads which current systems are unable to cope with. Like smart shopping should be available on whatever device consumers have at hand. Although considerable advances have been made in this area, developing and maintaining such applications is still a major challenge.

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