RFID based Smart Shopping: An Overview

Zeeshan Ali[#1]
[#1] Department of EXTC
Sardar Patel Institute of Technology Mumbai, India
[#1]leozee14@gmail.com

Reena Sonkusare[#2]
[#2] Department of EXTC
Sardar Patel Institute of Technology Mumbai, India
[#2] rk.extc@gmail.com

Abstract: **Electronic Commerce has become extremely popular with the rise in wireless technologies and other communication techniques. Purchasing and shopping at big malls is becoming daily activity in metro cities. There is a huge rush in such places during weekends and holidays. People purchase different items and put them in trolley. After completion of purchases, one needs to go to billing counter for payments. At the billing counter the cashier prepares the bill using bar code reader which is very time consuming process and results in long queue at the billing counter. A smart product is the one that aids the comfort, convenience and efficiency in everyday life. In this paper, we discuss an innovative concept of Intelligent Smart Shopping and Billing. The key idea here is to assist a person in everyday shopping in terms of reduced time spent while purchasing a product. The main goal is to provide a technology oriented, economical, easily scalable, and rugged system for aiding shopping in person.**

Keywords: RFID, Smart shopping, Retail, POS.

I. Introduction

One third of major shoppers buy groceries on a budget. They also worry about going over it. A new study in Atlanta grocery stores shows that smart shopping carts – carts that display the total price in a shopping cart – increased both a budget shoppers' confidence and how much they purchased.

When shoppers know exactly what they spend, they are more likely to reduce on brand names, and even though they spent an average of almost 22% more, they left the store happier than others who did not receive this feedback.

But this real-time shopping feedback actually leads nonbudget shoppers to be more frugal. On average, they spend 19% less, and purchase fewer national brands and more of the less-expensive store brands. The smart shopping cart looks like a normal one except for an interactive screen and scanner mounted near the shopper. Once the shopper swipes his store card, his shopping history is available for all kinds of purposes, from presenting a suggested shopping list to alerting him to discounts or reminding him about perishables purchased a month ago.

Although interest in smart shopping carts is increasing, retailers and consumer groups have concerns about how real-time spending feedback will influence shopping behaviour. Real-time spending feedback stimulates budget shoppers to spend more. In contrast, this feedback leads high budget shoppers to spend less. Furthermore, smart shopping carts increase intentions for budget shoppers while keeping them stable for high budget shoppers. These findings underscore fundamental unexplored differences between budget and high budget shoppers. Moreover, they have key implications for both infra and online retailers as well as app developers. [1]

II. Technology

Radio Frequency Identification (RFID) is becoming preferable technology as an alternative to barcode systems. RFID systems provide an automatic identification method, relying on storing and remotely retrieving data using RFID tags or transponders. An RFID tag is an object that can be attached to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Chip-based RFID tags contain silicon chips and antennae. In this paper, we have developed a smart shopping cart system that allows customers to manage their shopping list while shopping and only pay the bill at the checkout counter.

The shopping cart has the ability to calculate automatically and display the total prices of all the products inside it. This makes it easy for the customer to know how much he or she has to pay while shopping and not at the checkout counter. This way the customer can receive faster service at the checkout. The advantage for the shop owners is that they would need a less cashiers, which would result in a large cut in their costs. [2]

III. Existing Methods

RFID technology is amongst the most revolutionary technologies that will shape tomorrow's pervasive retail sales. This technology offers an important set

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of opportunities which improve the shopping experience of customers when visiting any self-service store. Indeed, this technology is increasingly promising to the extent of a potential replacement the barcode system as new low cost RFID tag manufacturing procedures have emerged.

A. Improving Store Management

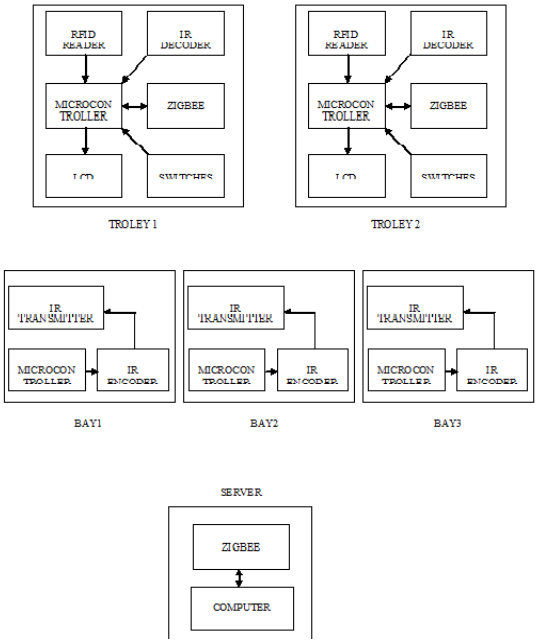
Using radio-frequency identification RFID data, which show the position of a shopping cart through an RFID tag attached to the shopping cart. The RFID data contain valuable information for marketing, such as shopping time and distance as well as the number of shelf visits. The authors analyse customers' purchasing behaviour and in-store movement information using POS data combined with RFID data. The purpose of this study is to discover a promising shopping path that can distinguish customers' in store movements by sequential pattern analysis using RFID data. These shopping paths are extracted using a pattern mining method. Finally, shopping paths are used in the decision tree analysis to generate the rules that expressed customers' in-store movements and purchasing characteristics. [3]

B. Improving Commodity Allocation

To be able to deploy commodities for sale in different shelves in a supermarket in order to obtain better benefit for sellers with considering convenience for buyers is an important topic in the retail area. A new method for allocating commodity shelves in supermarket based on customers' shopping paths and transactions data mining is being used by researchers. Here customers' shopping paths data can be obtained by shopping cart which has RFID tags embedded and shopping transaction data can be obtained from POS technology. Through integrating and mining the frequent paths data and transactions data, the See-Buy Rate - an approximate probability to purchase this commodity when they see the commodity, can be calculated. Based on SeeBuy Rate, we build benefit optimization model to obtain the optimal allocating solution with considering the profit, sales volume, and purchase probability of the commodity. [4]

IV. Developed Model

In this paper, we discuss an innovative concept of RFID Based Smart Shopping and Billing. The key idea here is to assist a person in everyday shopping in terms of reduced time spent while purchasing a product. The main goal is to provide a technology oriented, low-cost, easily scalable, and rugged system for aiding shopping in person. The developed system comprises of Cart location detection unit (CLDU), Server Communication unit (SCU), User Interface and display unit (UIDU) and Billing and Inventory management unit (BIMU). CLDU is used to smartly locate the position of shopping cart inside the shopping market to help in obtaining relevant product information. SCU will help in establishing and maintaining the connection of the shopping cart with the main server. UIDU will provide the customer with user interface and BIMU deals with the billing and inventory management in collaboration with the SCU.



These units are integrated into a smart enclosed system and are tested to satisfy the functionality. The smart shopping cart will help shorten the checkout lines thereby helping the customers at retail stores. The customers will be able to scan the items themselves and the LCD screen on the shopping cart will keep updating the total. This will turn out to be very beneficial for the retail stores as more people will enjoy the shopping experience and come more often to shop.

In the development and discussion of the intelligent shopping cart, we assume that the shopping arena is organized in aisles/bays, and each aisle is sufficiently wide enough for customers with shopping cart to move [5]. We use IR transmitters placed at both ends of the aisle and on the cart to collect information on the entry/exit status of the cart and the bay identification. Larger the distance between the aisles/bays, we will require stronger IR trans-receivers. Moreover the positioning of these IR trans-receivers on the shopping cart and on the aisles will be crucial to the proper functioning of shopping cart. Further, as IR technology works on line of sight, it is

important to ensure that there is no obstruction in the entrance or exit of each aisle. All the product information is stored in a database at a central server with the location information as an attribute. RFID tags are used to uniquely identify products [6].

V. CONCLUSION

The desired objectives were successfully achieved in the prototype model developed. The developed product is easy to use and economical. Though the project showcases the proof of concept, there are a few aspects that can be included to make the smart shopping cart more robust. To begin with, in this project the latency time of the wireless communication with the server may need to be considered. Secondly, the communication is not very secure. Another ZigBee module operating at the same frequency can easily intercept the transmitted data. This issue will have to be resolved specifically with respect to billing to promote consumer confidence. Further, a more sophisticated micro-controller and larger display system can be used to provide better consumer experience.

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