ISSN: 0975-766X
CODEN: IJPTFI
Available Online through *Research Article*
www.ijptonline.com

AUTO SIGNALING FOR PRODUCT FILLING ON THE SHELF IN RETAIL MART

J. Sheik Mohamed, **Dr. P. Chittibabu, Dr. S. Sreekanth,**
Asst. Professor, MCA Department SITAMS, Chittoor, A.P., India,
Principal, APGCCS, Rajampet, A.P., India.
Professor, CSE Department, SITAMS, Chittoor, A.P., India.
Email: sheik.ctr75@gmail.com

Received on: 18.10.2016 *Accepted on: 11.11.2016*

Abstract

In the recent past, the retail mart growth is increasing substantially from bigger cities to mid level town. Since retail mart is expanded, the number of products that they are dealing in the mart drastically increasing. So in every retail mart they use to arrange large number of variety of products in individual shelves for display inorder to make the customer to access those products. When the customer keep on fetching the desired product from the shelf, the number of product getting reduced from the shelf. In order to refill the shelf with right product in right quantity, different level of monitoring is essential i.e. manual or RFID monitoring. So to make the customer to get continuous accessibility of the product when ever the product is removed from the shelf, RFID monitoring will calculate the number of product taken from shelf and decrease the shelf stock and compares with minimum availability of product in shelf , once it reaches , it signals to in-charge person for refilling the product.

Keywords: Retail Mart; Signal; Sensor; Smart Shelf/

1. Introduction

The retail industry, which is characterized by highly complex supply chain processes, still faces stock out rates of 5-10%. This results in sales losses of up to 4% which corresponds to hundreds of millions of dollars for large retailers[1]. The most significant cause for stock out situations is inefficiencies in in-store logistics due to the lack of inventory visibility. In this project, the main thing that discussed about the product availability monitoring system, which anticipates stock outs before they occur and triggers the personnel to replenish the shelf. i.e., whenever the products on the shelf is getting emptied to a particular quantity, this system will gives the automatic signaling (message) for product filling in the shelf. This system continuously monitor the shelf for products availability. Here the condition is that, the shelf should contain

right quantity of products that are arranged in a proper order. Whenever the customer is taking the products from the shelf, it will identify and calculate the remaining products in the shelf and compare that products to the given condition i.e., minimum number of product (threshold). If the products in the shelf are equal to the minimum number of products, just it gives a signal (message) to the particular incharge of that floor. Also it will give the shelf number and number of products available in the shelf. In-stores, practices such as stock-taking are still carried out manually. Employees visually inspect retail shelves and take written notes on ordering quantities, which are later entered into an electronic ordering system. However, performing manual inspection is both, slow and expensive; and the process is highly susceptible to human error[2]. An Automatic monitoring system that seamlessly updates the stocks on a retail shelf and informs the personnel before an out of stock (OOS) situation occurs, allows considerably reducing the time span for replenishment. However, due to very small margins in the consumer goods industry, tag costs would devour a significant portion of the sales returns and therefore, a high market penetration of RFID item-level tagging is not to be expected within the near future [3].

1.1 What is Smart Shelf System ?

Quality and timely information is essential to combating merchandise availability problems. NeWave has made major technology advancement with the use of unique Wave™ Antenna, which provides retailers the ability to continuously monitor for merchandise availability at the shelf level. In simple terms, when an item leaves the shelf, "Smart Shelf" sees it even when it is not tagged. Based on criteria set by the retailer for low inventory limits, the "Smart Shelf" software signals an alert that can be sent to store managers, local and regional loss prevention personnel, and/or law enforcement as well as trigger an audio alarm message and a video capture alert within the store. This is making it easy to get real time in or out of stock shelf information available any time to any authorized person or group[4].Retailers are used to semi-passive deterrents. They are notified when their merchandise leaves the store or shows up in the local flea market. "The Smart Shelf" provides information on shelf item movement in seconds much like a motion detector for shelf merchandise. The "Smart Shelf" is an active deterrent against organized retail crime and out of stock shelf conditions. "Smart Shelf" provides item level movement history and reports. One can know what products are in stock when they are put on the shelf and when they were removed instantly or historically. This system uniquely removed the requirement to label each product with an RFID label costing 15 ~ 25 cents or more per item, as well as eliminating the significant

labor cost to tag all the merchandise. A retailer can target their most vulnerable product categories and see a very fast and highly attractive ROI not to mention the improvement in customer satisfaction.

1.2 About NeWave

NeWave Sensor Solutions is a leading provider of optimized solutions for today's most challenging item-level Radio Frequency Identification (RFID) problems. The company develops an open RFID technology platform based on the patent-pending Wave™ antenna that sets a new standard for Accuracy, Versatility and Efficiency[4].

NeWave's core technology was developed by the world-class ElectroScience Laboratory (ESL) of The Ohio State University, a pioneer in RF research and development, and is produced in partnership with Wistron NeWeb (WNC), the Taiwan-based global leader in antenna manufacturing. The company's management team leverages a strong heritage in the RFID and retail industries for its mission of applying optimized solutions to today's greatest RFID challenges.

1.3 A Brief NeWave History

NeWave Sensor Solutions was born out of years of research conducted at The Ohio State University's Electro Science Laboratory (ESL). The ESL is a major "Center-of-Excellence" within The Ohio State University Department of Electrical and Computer Engineering and is one of the largest Radio Frequency (RF) research laboratories in the world In fact, much of the original radio frequency research was completed by ESL for the benefit of the U.S. Department of Defense (DOD), which includes the creation of the Stealth systems. Dr. Den Burnside, the CTO of NeWave was a principle in developing the commercial application wireless research as an OSU Professor and the Director of the ESL. This experience has resulted in a unique RF understanding and revolutionary patent pending RF products that can advance RFID applications to the next level. NeWave and the ESL continue to corroborate on future RFID projects and development.

2. Existing Scenario

Retail Mart concerns for shopping various food stuffs, household, electronic gadgets, home appliances, fresh vegetables, home care and baby care products and others. The Mart helps us to shop all kinds of accessories under a single roof. Generally, the Retail mart consists of many number of floors. Each floor consists of different types of products and each product will kept in different shelves. Customers can access the products from the shelf. Whenever the products are taken from the shelf by customer, the stock in the shelf decreases and it would get emptied at one time. Before shelf get

emptied, the product availability has to be monitored by the in-charge person manually. As we have seen in the retail mart that they deal with some hundreds of product in same roof, so these products are segregated in hundreds of shelf in different floor. Monitoring all at once by in-charge person leads to few complexities such as customer dissatisfaction of product unavailability in the shelves in particular time and sales loss even though the product available in the warehouse.

2.1 DEMERITS

The existing scenario has forthcoming drawbacks. They are,

- ✓ Manual monitoring of all the shelves leads to time consuming.
- ✓ It leads to miss certain shelves where products are not available in the shelves.
- ✓ It increases the labor cost.
- ✓ It leads to customer dissatisfaction

3. Proposed Thought

Inorder to overcome the drawbacks of existing scenario, virtual sensor based shelves monitoring systems are simulated, It identify the product fetch by customer from the shelf with shelf number and it calculates the remaining number of product in the shelf. If the number of products reaches to minimum level, then it will give the signal to the administrator to fill the particular product in the particular shelf. The minimum level is calculated based on the product movement in the specified period. If the sales increase for particular product in the particular shelf, then the minimum level will be increase with the level of maximum threshold fixed for filling the products in the specified shelf and vice versa. It also includes the process of monitoring sales information and overall stock updations for each product.

4. Proposed Architecture

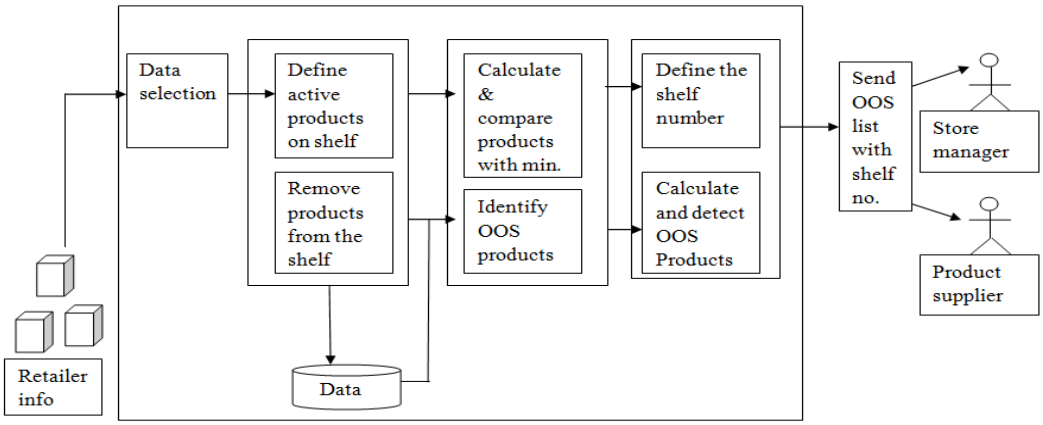


Fig. 1 Architecture flow of smart shelf system.

5. Simulated Implementation

Fig. 2 Home page.

It consists of two functionalities such as customer and administrator functionalities. The customer functionality indicates the virtual sensor monitoring of product access from the shelf by customer. The administrator functionality indicates the passing information to fill the right product in the right shelf after getting information from virtual sensor and stock monitoring in the warehouse.

Fig 3 Automatic Signal Operations.

The customer login meant for authorized customer entry in which customer can access the product from various virtual smart shelf in retail mart. But in real scenario, every shelf in the mart is attached with sensor by which the customer can access the product directly. The administrator can also understand that who are all customer entered in to the mart based on login entry for virtual product access as well as the sales of various products in the mart

The "About Sensor" button gives the details of the sensor which is used in the system. In the real scenario, the "NEWAVE SENSORS" can be used for monitoring every shelf. But here virtual sensor monitoring is adapted.

The "simulated stock filling" button is used to set virtual sensor attached shelf with specific product for customer accessing and also initiates the monitoring process for stock availability of the shelf and further automatically sends signal to administrator whenever number of products in the shelf reaches to minimum level.

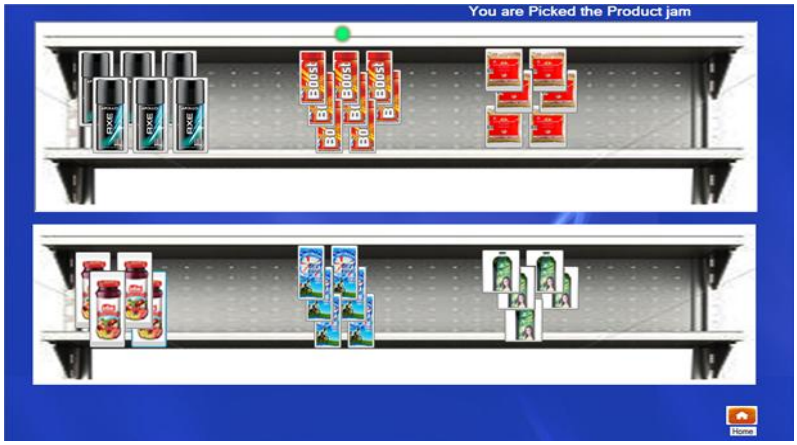


Fig. 4 Smart shelves with product fill.

The smart shelves consists of six shelves with different products like axe, boost, masala, jam, surf excel and hair oil. These are arranged in the shelf in a particular order. The shelf consists of limited number of products. The first shelf consists of axe with maximum of 10 products. In the real scenario, the shelves may consists of some hundreds of products but here it is limited to few number of products. Similarly every product in the each shelf is considered in the same way. The authorized administrator maintains the various customer authentication and to monitor the product movement based on customer access and to monitor the automatic signal information for product filling in the shelf for various product in the mart.

Fig. 5 Administrator Role.

The administrator has the following functional roles such as stock monitoring, stock level calculation, sales information report generation and maintain the stock filling details.

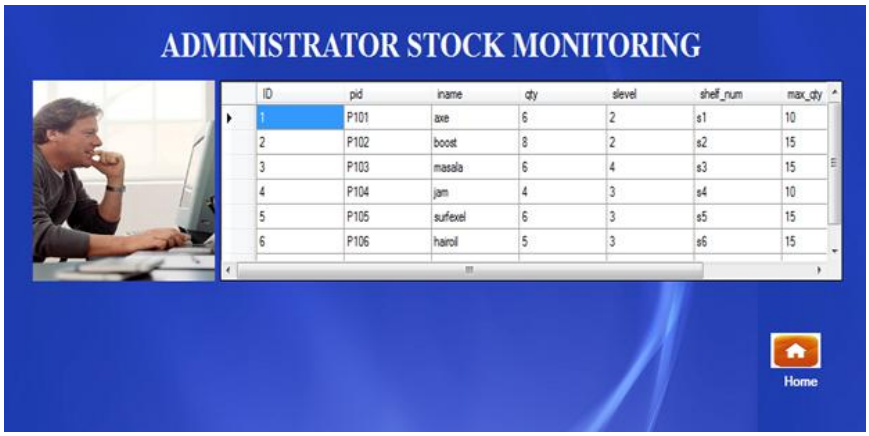


Fig. 6 Product movement monitoring.

When ever the customer fetches the particular product from particular shelf, it reduces the number of product from the existing number of product availability in the virtual shelf which reflects the overall product movement in the mart.

The "stock level calculations "fetches the frequency of every product movement in previous month or current month for calculation and accordingly it keep up the minimum of product availability in the virtual shelf, so that whenever the product moved from the virtual shelf according to calculated threshold value, it matches and pass the signal with shelf number and product name to refill the shelf.

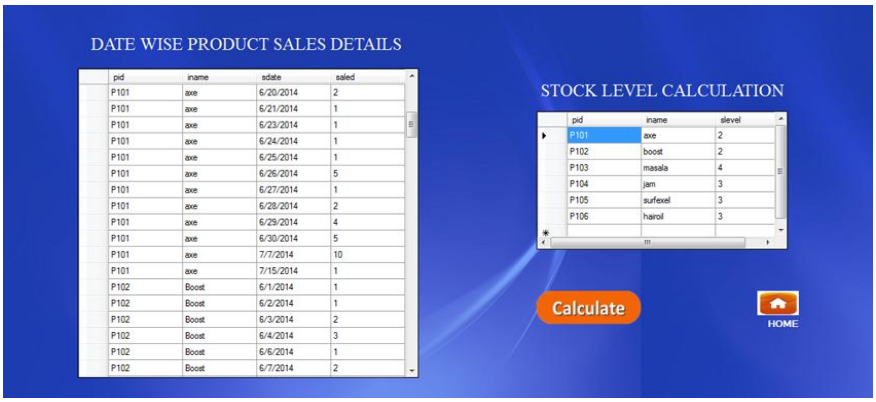


Fig. 7 Product sales details and minimum stock monitoring in virtual shelf.

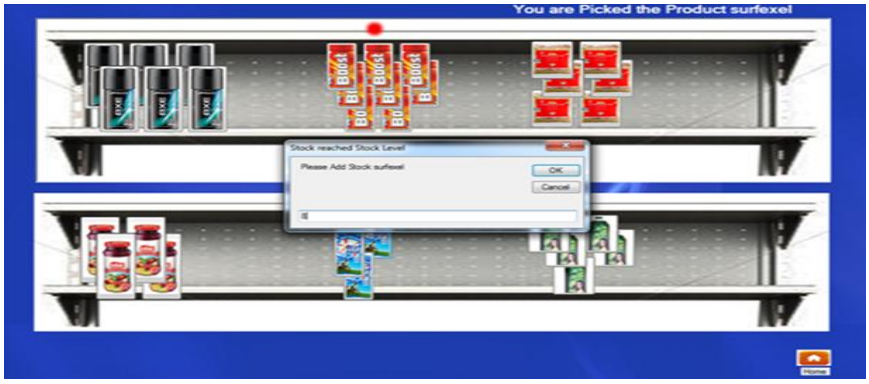
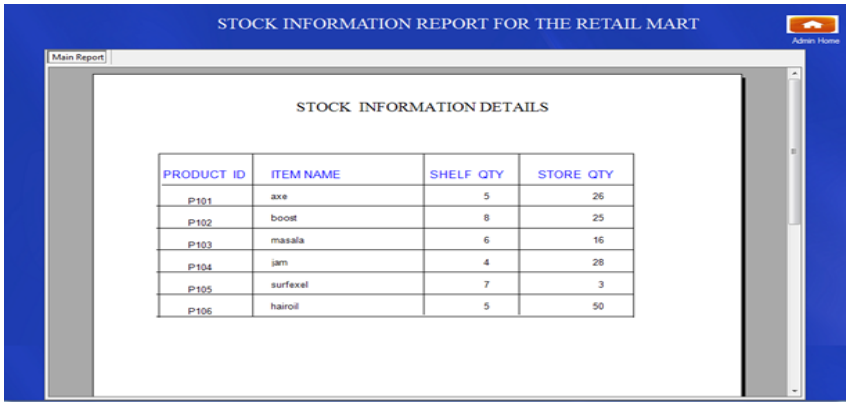


Fig. 8 Virtual Stock filling.

Whenever the minimum stock level reaches in the shelf, the system will identify which product is getting emptied and it will send the sense message (signal) to the administrator to add the stock in the particular shelf. Then the administrator adds the suitable number of products in the shelf virtually. But in reality after receiving the message by administrator and in turn the administrator pass the same information to the warehouse in-charge to refill the shelf with concern product. When the product is filled virtually in the shelf, it will compare the original warehouse stock availability with the added quantity in the shelf. If the added quantity is more than the original quantity which is there on the warehouse then it will show the actual stock availability and it will add the products specified in the shelf. Otherwise it adds to the shelf quantity and update the warehouse stock details.

Fig. 9 Stock position.

It shows the stock position when the administrator add the stock more than the original stock. It will not allow adding the products in the shelf and at the same time it will insist the administrator to place the purchase order to increase the warehouse stock.When administrator adds less number of available products than the original stock in the warehouse, then it allow to fill that number of products on the shelf.



10 Combined report about product quantity in shelf and warehouse.

This report shows the particular product current availability both in shelf and warehouse.

Fig. 11 Date wise report on shelf product filling.

6. Conclusion

Now a days, the Retail Industries are still facing significant stock-out rates of 5-10%, which result in sales losses of up to 4%. In Europe, the most significant cause of out-of-stock situations is due to unsatisfactory shelf replenishment. Early detection of low stocks combined with timely replenishment by the store's personnel could significantly reduce out-of-stock situations. This system presents a pervasive product availability monitoring system for retail shelves that increases the visibility of stocks, anticipates out-of-shelf situations and informs the personnel when a particular shelf needs to be replenished. This monitoring system is based on virtual sensors that offer high scalability. This technology is very useful for identifying the product moving from the shelf and also no requirement of any RFID tag based system. This is very flexible for any retailers.

7. Future Enhancement

The frequency of product movement can be considered to analyse the future requirement in the particular season to place the order according to sales trend

References

1. Gruen, T.W., Corsten, D.S., Bharadwaj, S.: Retail Out-of-Stocks: A Worldwide Examination of Extent, Causes and Consumer Responses, Report, Grocery Manufacturers of America, The Food Marketing Institute and CIES – The Food Business Forum, Washington, D.C., 2002.
2. Tellkamp, C.: The Impact of Auto-ID technology on process performance – RFID in the FMCG supply chain, Dissertation No. 3182, University of St.Gallen, Switzerland, 2005.

3. Woods, J., Piszczalski, M., Davison, J., Steenstrup, K., Vining, Hype Cycle for Radio Frequency Identification, Report G00129258, Gartner Research, p. 9, 2005.

4. Anusha, D., Sheik Mohamed,J., and Chittibabu,P., Automated Bill Generation on Customer Product Filling in Simulated Basket at Shopping Mart, I- Manager's Journal on Information Technology, ISSN: 2277-5110, Vol. 3, No. 3, pp.32-39, June - August 2014

5. About NewWave Sensor extracted from www.newavesensors.com