

## A Review on Smart Trolley

Aakash Kondaskar<sup>1</sup>, Kartikkumar Mahyavanshi<sup>2</sup>, Prasad Joshi<sup>3</sup>, Bhushan Kadam<sup>4</sup>

Department of EXTC, VIVA Institute of Technology, Mumbai-401303

**Abstract**— Shopping malls visit is nowadays becoming daily activity in metro cities. There is a large rush in such places throughout weekends and holidays. People purchase different items and put them in trolley After purchase customer needs to wait in queue for billing. This paper provides an overview of the existing technologies use for billing and also discuss about the new technologies. This paper provides information about the technologies based on RFID, smart sensors, communication technologies and protocols. In this analysis survey we've got enclosed all the present eventualities supported product identification and conferred RFID based mostly good cart. We have also mentioned the pros and cons of all methods and issues regarding the research.

**Keywords**— Barcode Scanner, RFID Tag, RFID Reader, Smart Cart, Smart Shopping.

### I. INTRODUCTION

Shopping Centre / mart is a common spot/place where individuals get their everyday necessities as required. Some of the time clients have issues regarding the excessive time wasted at the billing counter or in a queue. In this innovative world, each grocery store and supermarkets utilize shopping trolleys with a specific end goal to help clients to choose and store the items which they expect to buy. Customers usually purchase the products required and place them in their carts and thereafter wait at the counters for payments of bills. The payment of bills at the counters is really troublesome and time-consuming process which results in heavy crowd at the counters. This had led to innovation or modification of shopping trolley by various experts and engineers. The papers referred for the review is categorized on the basis of different methods used for scanning and billing of products, as well as wireless communication and Human detection methods.

Following sections are made on the basis of that:

1. Use of Barcode Scanner
2. Use of RFID
3. Wireless Communication
4. Human Detection & Tracking
5. Android application based

### II. LITERATURE SURVEY

#### 2.1 Use of Barcode Scanner

The Barcode is an optical machine-readable representation of information with reference to the item to that it's attached. On the opposite hand, the RFID is that the use of wireless non-contact system that uses radio frequency electromagnetic field to transfer information from a tag connected to an object for the purpose of automatic identification and tracking [1].

The camera-based barcode scanner is used here to identify a product so that its price can be determined from the database, which stores all the relevant information about all the products. Along with price, expiry date, weight factor is also considered. If the weight of a product estimated is not the same as the actual weight of the product, it is interpreted as a case of discrepancy. An image comparison algorithm is run on these two images to find if they are the same products. If they are not found to be the same, it is interpreted as a case of discrepancy. The two images are removed from the memory of the system just after obtaining the result from the algorithm in order to restrict the memory usage of the systems at the cart. Since this proposed system is not fully automatic as it involves manually scanning of product by human. The system that is developed is very reliable, fair and cost-effective [2].

"Intelligent searching Basket" that aims reduce back, and probably eliminate the overall waiting time of consumers is projected.

The automatic shopping cart system here integrates a cart (trolley) with a pair of sets of barcode scanners placed at two totally different checkpoints – the entry and exit points respectively. It facilitates on spot barcode scanning of the products which he intends to purchase. A wireless smart-device makes note of all the scanned commodities of the actual trolley (with allotment number) and is connected with the Supermarket's backend database. The main advantage is to reduced manpower and time but disadvantage is expensive to implement on larger scale [3].

## 2.2 Technology behind barcodes

Barcode technology works of off a principle known as symbology. Symbology at its basic type is what defines the barcode; it determines the mapping and interpretation of the encoded info or knowledge. This encryption permits the scanning device to grasp once a digit or character starts and once it stops, almost like a binary representation. We recognize barcodes as associate array of parallel lines alternating between white and black lines. Barcode technology provides an easy and cheap technique of recording information or data in an exceedingly range of applications. A continuous symbology is marked by the characters beginning with a black line and ending with a white line or space, while discreet symbols have characters encoded as a black line a space and then another black line. This takes care of the characters and the way every individual range or letter is scan. The line or linear barcode technology is usually brought up as 1D encoding. While we are most familiar with these barcodes, there are more complex codes that employ the use of dot matrixes to achieve a more complex encoding process that can store and identify far more information. These are referred to as 2D or, in some cases data glyphs.

**TABLE 1  
 COMPARISON OF 1 D BARCODE AND 2 D BARCODE**

1 D Barcode	2 D Barcode
It represents data in the widths (lines) and the spacings of parallel lines also known as linear barcode.	It has patterns of squares, dots, hexagons and other geometric patterns.
It requires larger space.	It requires smaller space.
Holds less than 85 characters	Encodes/holds hundreds of characters.
A majority of customers are set up to use Linear barcodes (Linear scanner).	Requires a 2D barcode scanner.
Types: Code128, Code 39, and UPC.	Types: s Data Matrix, PDF417, and QR Code.

### 2.2.1 Limitations

1. They can only be used for a single time (use and throw).
2. They can be easily deteriorated or degrade as the time passes by.

### 2.2.2 Use of RFID

Radio Frequency Identification (RFID) is turning into desirable technology as an alternate to barcode systems. RFID systems offer an automatic identification technique, relying on storing and remotely retrieving information from RFID tags or transponders. An RFID tag is associate object which will be attached to or incorporated into a product, animal, or person for the aim of identification using radio waves. Chip-based RFID tags contain silicon chips and antennae. RFID technology is amongst the most revolutionary technologies that will shape tomorrow's pervasive retail sales. This technology offers an important set of opportunities which improve the shopping experience of customers when visiting any self-service store [4].

A system in which by connecting RFID labels to the items and reader with an LCD implemented in purchasing cart itself. From this framework client can possess data related to cost of each thing which are inside cart and furthermore absolute cost of the thing about the item. This framework will save time of clients and also the hard work required in handling of trolley as well as the

labour required in shopping center with respect to cost of the item [5].

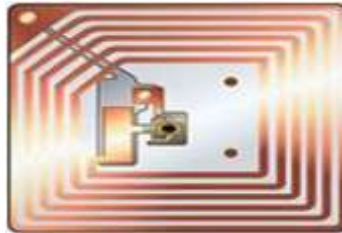
A smart shopping cart system had been proposed that will keep the track of purchased products and also online transaction for billing using RFID and ZigBee. The system will also give suggestions for products to buy based on user purchase history from a centralized system also there will be RFID reader at the exit door for anti-theft [6].

Another smart cart system that allows customers to manage their shopping list while shopping and only pay the bill at the checkout counter had been developed. The cart has the power to calculate automatically and show the overall costs of all the products inside it. This makes it simple for the client to understand how much he or she needs to pay. This way the client will receive quicker service at the checkout [7].

### 2.3 Technology behind RFID

#### 2.3.1 RFID System includes 3 Major Components

- a) A RFID tag: It consists of a silicon microchip attached to a small antenna and mounted on a substrate and encapsulated in different materials like plastic or glass veil and with an adhesive on the back side to be attached to objects.



**Fig 1. RFID tag**

- b) A reader: It consists of a scanner with antennas to transmit and receive signals and is responsible for communication with the tag and receives the information from the tag.



**Fig 2. RFID reader**

- c) A Processor or a Controller: It can be a host computer with a Microprocessor or a microcontroller which receives the reader input and process the data.

#### 2.3.2 Manufacturing and management issues in RFID

Manufacturing of tags is not yet 100% failure-free today; about 20–30% of tags used in early RFID pilots have been defective Attempting to read several tags at a time may result in signal collision and ultimately to data loss. Tags may be damaged during usage [8].

#### 2.3.3 Limitations

1. An RFID reader can scan a tag as long as it is within frequency range.
2. Cost is high.

3. Adverse conditions of the environment and improper placement may corrupt reading.

**TABLE 2**  
**COMPARISON OF BARCODE AND RFID**

Attribute	Barcode Scanner	RFID Scanner
Line of Sight	Required	Not Required
Accessibility Range	Up to few inches	Up to few meters
Content Updating	Cannot be Updated	Can be Updated
Reliability	Damaged tags won't work	Damaged tags can work
Read/Write	Read Only	Read and Write
Information Capacity	Very Less	More than Barcode

#### 2.4 Wireless Communications

In this paper interfacing of two Xbee modules is done with the two Arduino Uno microcontrollers. One Xbee is connected with the Arduino on the shopping cart reading the RFID card data while the other Xbee is connected to the Arduino containing the database of products. This Xbee receives the RFID card data compares it with the database and reads back the cost [9].

Different possibilities and way to design and implement a ZigBee-based data transmission and monitoring wireless smart sensor network integrated with the Internet is described in the paper. Implementing of an economical such system needs the employment and integration of various hardware components and programming languages. In order to integrate the WSN (Wireless Sensor Nodes) or Sensor Nodes with Internet-based services and centralized database (DB) relay nodes are used. WSN became very popular in many commercial applications as well as home environment monitoring and control [10].

#### 2.5 Human Detection & Tracking

The commercialized Kinect sensor is employed to detect the gestures of the human body (arms) by using skeleton detection mobile shopping cart equipped with Kinect could execute different gesture command, for example, go ahead, draw back, set stop and so on. Skeleton tracking is done by using NITE modules and OpenNI Modules provide C++ based APIs for skeleton detection and tracking. They observed the response time of cart is within 0.5 second. Valid range of Kinect is from 0.4m to 4m in distance and the angle of vision covers 57.5 degrees horizontally angle and 43.7 degrees vertically the accuracy of go ahead, draw back and stop command is 93%, 94.5% and 97.9%. They believe that mobile shopping cart will provide better services to the customers [11].

An approach for tracking a target person by a mobile robot is presented here. The robot is equipped with optical device range finder and stereo camera. The robot initially selects the target person from all the human beings which are detected then computes and saves the target person's upper body, face and legs data. Robot then tracks the target person by tracking his face. Stereo camera is employed to search out the gap and angle between the target person and the robot. Thus, robot maintains a selected distance and an angle from the target person. They implemented it on a mobile robot and obtained the result [12].

#### 2.6 Android application based

In this application-based cart system after purchasing each product customer can scan the product (i.e. NFC tag) via NFC scanner which is in built in the smart phone. The total is automatically done by the server. The server and the smart phone are connected via Wi-Fi. The dealing server or owner can add, delete, update, and modify the details of products. This application is smarter than previous shopping application. The software is specially designed in a such a way that only the authenticate person can have

permission to add, remove or modify user documents while user can only process them and if he/she wants to do any alteration the user needs to go to regional officer i.e. This are the major constraints of the software which is developed [13].

## 2.7 Demerits

1. If any customer not has smart phone, then he cannot use that our application.
2. If customer is not literate, then customer will not possible to understand the application.

## III. CONCLUSION

As we can see there was a huge technical development in implementation of shopping cart / trolley in order to give comfort and ease to the customers which also resulted in reducing queues at the cash counter. As Smart phones become more and more popular in today's life, so we need to focus on that database related application field i.e. mobile oriented purchasing of product or billing. Also moving the heavy (product filled) trolley might be a difficult task for senior citizens or disabled person so implementing an automated customer following trolley would be beneficial.

## REFERENCES

- [1] Paxal Shah Ms. Jasmine Jha Nirav Khetra Manmitsinh Zala "A Literature Review on Improving Error Accuracy and Range based on RFID for Smart Shopping" IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 10, 2015
- [2] Udita Gangwal, Sanchita Roy, Jyotsna Bapat "Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks" SENSORCOMM: The Seventh International Conference on Sensor Technologies and Applications, 2013
- [3] S. Sainath, K. Surender, V. Vikram Arvind, J. Thangakumar "Automated Shopping Trolley for Super Market Billing System" International Conference on Communication, Computing and Information Technology (ICCCMIT- 2014)
- [4] Zeeshan Ali, Reena Sonkusare, "RFID based Smart Shopping: An Overview", International Conference on Advances in Communication and Computing Technologies, 2014
- [5] Komal Ambekar, Vinayak Dhole, Supriya Sharma, Tushar Wadekar "Smart shopping trolley using RFID" International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 4 Issue 10, October 2015.
- [6] Ankush Yewatkar, Faiz Inamdar, Raj Singh, Ayushya, Amol Bandal "Smart Cart with Automatic Billing, Product Information, Product Recommendation Using RFID & Zigbee with Anti-Theft" 7th International Conference on Communication, Computing and Virtualization, 2016
- [7] Suganya.R, Swarnavalli, Vismitha, Mrs. G.M. Rajathi "Automated Smart Trolley with Smart Billing Using Arduino" International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 4 Issue 3, March 2016.
- [8] Mandeep Kaur, Manjeet Sandhu, Neeraj Mohan and Parvinder S. Sandhu "RFID Technology Principles, Advantages, Limitations & Its Applications" International Journal of Computer and Electrical Engineering, Vol.3, No.1, February, 2011.
- [9] Akshay Kumar, Abhinav Gupta, S Balamurugan, S Balaji and Marimuthu R "Smart Shopping Cart" IEEE, 2017
- [10] Dražen Pašalić, Dušanka Bundalo, Zlatko Bundalo, Branimir Cvijić "ZigBee-based Data Transmission and Monitoring Wireless Smart Sensor Network Integrated with the Internet" 4th Mediterranean Conference on Embedded Computing MECO – 2015
- [11] Shengnan Gai, Byung-Ju Yi, Eui-Jung Jung "Mobile Shopping Cart Application Using Kinect" 10th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI), October 31-November 2, 2013
- [12] Badar Ali, Ahmed Hussain Qureshi, Khawaja Fahad Iqbal, Yasar Ayaz, Syed Omer Gilani, Mohsin Jamil, Naveed Muhammad, Faizan Ahmed, Mannan Saeed Muhammad, Whoi-Yul Kim, and Moonsoo Ra "Human Tracking by a Mobile Robot using 3D Features" International Conference on Robotics and Biomimetics (ROBIO) *Shenzhen, China, December 2013*
- [13] Mansi Mhaske, Mayuri Sawant, Ekta Bhattad, Amruta Gaikwad, Manoj Mulik "Smart Shopping System Android Application", *IJARCSSE- International Journal of Advanced Research in Computer Science and Software Engineering, Volume 6, Issue 11, November 2016.*