

A Survey Paper on Smart Trolley Using RFID Technology

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Abstract

India is one of the fastest growing economies in the world and aspires to become a 5 trillion dollar economy. E-commerce has surely spread itself and there have been many advancements in this field. The working class and most of our community prefers to go to malls or supermarkets and get their shopping done. Due to increasing populations, shopping is a cumbersome process as one has to wait in long queues to get their processing done. Clearly, it is a waste of time and a tedious affair. The major problem lies with the system of barcodes where every item is being scanned individually which makes the process slow and time consuming. RFID based shopping cart is a new way of shopping and avoiding long queues. The object would be tagged with a unique reader tag, which will be identified by the RFID reader attached to the trolley as the object is added to the cart. As the scanning is done the cost of the product will automatically be displayed on the screen attached to the cart. The bill value changes dynamically as the objects are added and subtracted.

Keywords— UHF RFID ,RFID Modules , ZigBee , Shopping Cart , Supermarkets , Smart Trolley

I. INTRODUCTION

RFID (Radio Frequency Identification) is a versatile and easy to use technology in the IoT domain. RFID tags are generally used for identification of products using radio waves. RFID sensor are in great demand due to effective working and faster scanning and detection. It possesses a great advantage over the barcode scanning system technology as in RFID there is no assigned of line of sight, as opposed to barcode scanners, where the object is scanned if and only if its placed under a line of sight. RFID scanning distance can be easily adjusted as per needs. Every customer would be provided with a unique RFID tag enabled cart.

The concept addresses the expectations of customers whose basic demand is to reduce the various problems in the way of making their purchase. By initiating the idea of an RFID based shopping cart, people would easily understand the bill of products themselves, irrespective of the presence of staff of the shop as details of product would be readily available and would be displayed on the trolley as they add the product in the trolley. This outcome of this project will not only be in favor of the customers but also the mall owners who can make a one-time investment which can lead to long-term benefits in terms of business as well as customer satisfaction.

II. LITERATURE SURVEY

People have consistently imagined and built up an innovation to help their needs as far back as the start of humanity. The fundamental reason for headway in innovation has been in limiting errands and making regular tasks simpler and quicker, regardless of the different spaces accessible. A significant task on which people are discovered spending significant measure of time is shopping. For this at start we used barcode system but after some years it also started to have issues like LOS (line of sight), increasing queue etc. so overcome this issues a concept of smart trolley with RFID technology was proposed

The implementation of IOT (Internet of Things)[14 15] based automated trolley system was reported in [1]. Framework is utilized to ease lines in shopping centre by utilizing RFID module. The RFID reader will peruse the RFID Tag set on the item when the item fall in the trolley. In the event that, the client needs to expel any item then he should expel that item from the trolley. The LCD will show the

subtleties of the expelled item like name, cost and the absolute bill and with the help of Xampp server the bill will be send to the cashier, flowchart is shown in Fig 3.

Paper[2] describes the implementation of a Smart Shopping Cart using ZigBee networks. The reliable and cost efficient system design also ensures detection of deception. Thus, the smart system attracts both the buyers and sellers and ZigBee acts like Xampp server but is more reliable.

Paper[3] designs a shopping cart by taking inspiration from a shopping basket which is under development by Panasonic, in which each item is tagged using UHF RFID [range: 916-924 MHz] Two Circular Polarized (CP) Patch antennae used to read RFID tags in different orientations. They also include a factor for measuring effectiveness of function called as RSSI (Return Signal Strength Indicator) RSSI measurement plays a significant role in this smart trolley application as RSSI measurement indicates the directional gains that are needed for the antenna development. CSL468 RFID reader used having 16 ports and scan speed of 300 tags/sec.

Paper[4] proposes a cart to provide billing services using a combination of RFID and Li-Fi (Light Fidelity) systems. However, both are not used together. An option is provided at the beginning, when the trolley is put to use by the customer, to choose whether to use RFID or Li-Fi for scanning purposes. This system uses Arduino Uno Atmega328 microcontroller along with RFID module (tags and reader) and Li-Fi transmitter and receiver. If RFID option is chosen, the RFID reader is activated and on adding items into the cart, RFID tags are scanned. Otherwise, on choosing Li-Fi option, Li-Fi receiver is activated. Work flow in both cases remains the same.

In Paper[5] the authors have designed a construct of shopping trolley by using Arduino Uno, infrared sensors, RFID Module, LCD display, Wi-Fi modem and added a DC gear motor to enable trolley automation. It uses Ethernet Shield to connect to the Internet using Ethernet Library. The idea is to connect trolley to cell phones using Wi-Fi/Bluetooth and an Android app, in which a map of the mall is displayed. If customer wants to go to food section, select food section on map, and the trolley moves automatically to the food section. Uses RFID module (combination of tags and reader) to scan products.

In Paper[6] authors employed the method for the automatic billing system for supermarkets. The basic idea behind this project is that to decrease the hassle in the supermarkets so that no one has to wait in queue for hours and no one have to waste their time in billing. In the proposed system the authors have used the RFID technology for billing the items which in then integrated with ARDUINO. In this project they have not the mentioned the ARDUINO type. Also the final bill will be then send to the cashier with the help of USB and the bill can be printed on the spot. For making the making the circuit they have used DipTrace. DipTrace is an open source software that enables us quick and easy designing of circuits. For making the admin's portal they have used Visual Basic software and with the help of Java programming language they have created the GUI for the system. So as soon as you keep something in the cart it gets scanned by the RFID reader and the bill generation starts. When the shopping gets over the customer has to press the bill button and then connect the trolley to with the computer and transfer the bill.

In Paper[7] EM-18 RFID scanner module has been used. It uses a RFID reader which will read 125 kHz tags. So, it will be known as a low frequency RFID reader. It offers out a serial output and contains a range of approximately 8-12 cm. There is an inbuilt antenna and is connected to the laptop with the assistance of RS232. This module is capable of handling multiple tags at a time also the range is very less so it will not get contact with other trolley. The RFID Readers here used are big tags with range of 125KHZ which can be detected by EM-18 Module. It shows the real time billing and you can even delete the item you don't want by pressing the delete button. In this author has used ARDUINO Uno which one of the cheapest and most efficient model in the market. It contains everything required to support the microcontroller merely connect it to a laptop (or applicable wall power adapter) with a USB cable or power it with an AC-to-DC adapter or battery to get started. Once the item is scanned it will start billing and you can remove the item if you want however they have not mentioned how the receipt

will be transferred to the billing section as they also want to keep the databases updated for refilling the stock

In Paper[8] the authors designed a system for shopping mall. The system is placed in the trolleys. It consists of RFID reader and each product has RFID tag. The billing is done in smart trolley itself. Product name and its price is displayed on LCD screen. At the cash counter the total bill is relocated to Cashier Computer by wireless Radio Frequency module. The disadvantage of this scheme is after completion of shopping, a key is pressed indicating the final promoting amount of the entire item, and we cannot add or remove the products, architecture is shown in Fig 2.

In Paper[9] the authors have devised a system which consists of GSM, RFID, Automatic Billing, OTP, ZigBee, PIC, etc. In this scheme, the item can be read by the RFID reader and the total of the item is showed on the LCD screen. They characterized this paper because they added some additional features in existing system; like right now, thing can be perused by the RFID peruser and the aggregate of the thing is appeared on the LCD screen. They portrayed this paper since they included some extra highlights in existing framework; like right now item weight and name appeared in plain view; in the event that thing weight is not exactly put away weight, at that point signal will blare. There is a key cushion relegated to settle on the decisions of client. If there is unauthorized task being conducted then the user would either get a buzz sound or a message via GSM module. LED system are evenly used so as to make user alert about unauthorized activity, architecture is shown in Fig 1.

Paper[10] describes a shopping cart which uses the ATmega microcontroller to carry out various functionalities and the connections are made to ZigBee technology, power source, EEPROM and display unit. ZigBee network provides low cost low power connectivity for equipment that needs battery life long for several months. RFID reader is technically used to provide a unique id and mostly used to electronically record the items and information related to object using radio signals. A central automated billing system has been assigned where all data is gathered according to their personal identification device, via ZigBee communication. There the net calculations are done. Customer can get their billing details via their unique cart number.

In Paper[11] there is a correspondence between android gadget, principle server and charging framework entryway framework by means of ZigBee module. The absolute net measure of the items in the trolley is being determined utilizing android gadget and updates on server. On adding a product in cart, the RFID Reader reads the Product ID and the information related to it is stored on a controller. There is a correspondence between android gadget, principle server and charging framework entryway framework by means of ZigBee module. The absolute net measure of the items in the trolley is being determined utilizing android gadget and updates on server.

In Paper[12] the authors proposed an automatic billing system by means of a smart cart which comprises of an RFID reader which will read the products containing the RFID tags when put into the smart cart, hence ensuring an auto-billing process for customers and the payment can also be done through mobile application. Radio Frequency does uses signals to identify signals and objects. It reads information from a long distance as there is no line of sight so there is no need of any physical contact. Tag then does create disturbance which is responded by decoder. A far-field antenna uses capacitive coupling to charge the RFID tag. Capacitive coupling occurs when the RFID reader's antenna propagates RF. Now here two types of RFID are available they are passive and active. Passive tags don't have an internal power source where active tags do work on battery. The electromagnetic field that surrounds an RFID antenna can be broken up into two segments – near-field and far field.

Paper[13] proposes a system where every item would be read by scanning tag as soon as its drop in basket. Also the expiry date of the product is displayed alongside the product. The most profound and clear system has a unique id associated to each product as soon as the product is being read by reader it automatically generates the information regarding the product on the screen. To store the product id and details and microcontroller memory is being used. As soon as the data about the product is being displayed on LCD screen the bill has been transferred to the system PC via GSM/GPRS module. As per the test, when inserting an item into the trolley or deleting an item from the cart, the cart is able to

precisely and perfectly read it. One impressive experimented output is that the metal outside the cart restrict signal the signal to a high degree that when the reader is inside the cart, no other item other than the cart is being read. This clearly indicates that an item put into a smart cart will not be damaged or read by a nearby cart accidentally.

III. WORKING AND METHODOLOGY

The key target of future framework is to convey a skill worried about, ease, effectively available, and an even framework for supporting shopping. The RFID control driven electronic shopping trolley is worked to improve the total shopping understanding for PC gadgets store shoppers. After enrolling a thing in the shopping trolley, the shoppers can permission assortment of thing data.

At first the customer goes into the mall and takes the SMART SHOPPING CART which will be equipped with an RFID scanner. Then he/she must shop as he/she does regularly. While the customer will be shopping, RFID scanner assembled on the cart will be generating the invoice simultaneously. Whenever the customer adds an item with RFID tags into the cart, the cart recognizes it and adds in the billing section. In this way, whenever the customer will add or remove anything the scanner will detect this, and accordingly the invoice will be generated.

Now various methods are used to scan the RFID tags. Some are using ATMEGA 32 microcontroller, Em18 module and one of the best is RC522. Like scanning has these many options generating the bill and sending it to the cashier has also many options like we can use Xampp server, ZigBee module, USB wire, Mobile app or GSM module.

Some of these technologies have been used while some are still in experimental phase. So basically what this project does is that it enhances customer shopping experience. The bill is generated simultaneously, so you need not stand in a queue, waiting for people in front of you to unload their items so that the cashier could scan them and generate invoice. Also when the bill is being generated, you can keep track of your budget and by this you can also save money and time

IV. FIGURES AND TABLES

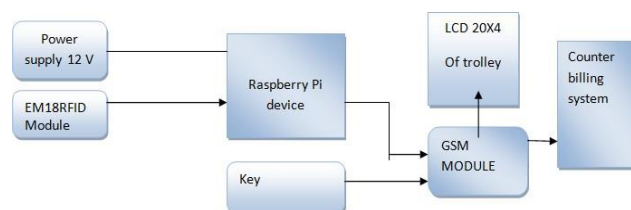


Fig.1 Architecture of RFID enabled Trolley,Paper[9]

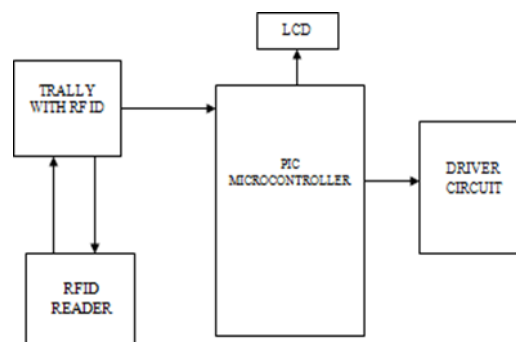


Fig.2 Architecture of RFID enabled Trolley Paper[8]

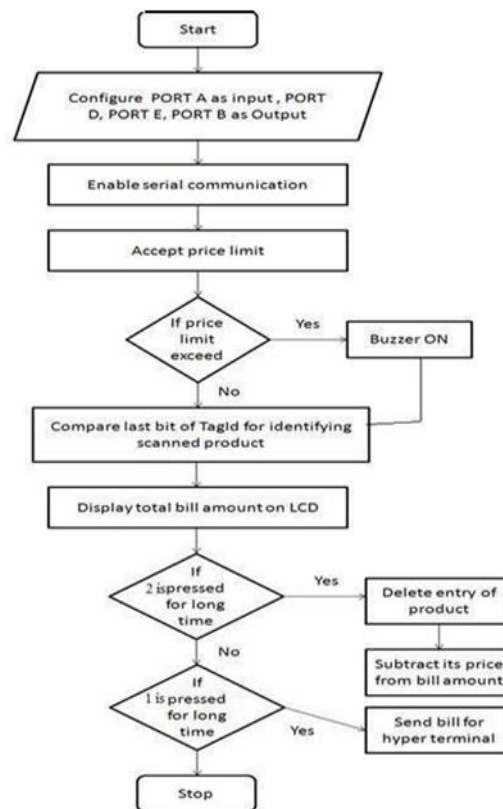


Fig .3 Flowchart of RFID enabled Trolley Paper[1]

V. CONCLUSION AND FUTURE SCOPE

While there are many papers that propose an idea for shopping carts, none of them have been able to produce an economical version of the same. However, there are many options that can be used to increase the productivity of this project. Author could have provided autonomous shopping carts which move to the section as customer click on a map on either the cart screen or on a mobile application. Also, the stock of all products could be updated in real-time, so that customers get to know which products are not available at the moment, saving their time. Future advancements could also include use of enhanced RFID readers that operate in high frequency which can read multiple tags simultaneously. Mobile application can be developed to avoid smart card and GSM.

According to customer's point of view, this project has redefined the way of purchasing. Evidently RFID has outsmarted barcodes by its accuracy, fast response and durability. This concept has erased the tradition of customer relying on the shopkeeper for acquiring information about products. Billing is completely avoided which in turn saves time for the customer and makes process easy for shopkeeper. It avoids queue for customer since billing is completed in the trolley. It reduces one third of the overall investment of the shopkeeper for billing department.

Thus the model allows better shopping experience using improved technology which can be handled by any common man who just knows to read and write things.

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