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Automatic Billing of Smart Shopping Cart by Using RFID and ZIGBEE

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Abstract:

Now-a-days shopping is increasing rapidly. People take the items and put it into trolley. After shopping they go at the billing counter for billing but there are many people standing in queue for billing purpose. So more time is required for the individuals for billing because of existing barcode technology. To reduce this time we have implemented a system which is based on RFID technology[3]. The system contains the items attached with RFID tags. The cart is interacting with the main server and it will have the facility to generate the bill for all the products added into the cart. The proposed system will be helpful for avoiding queues in shopping malls for billing. The customer can identify the location of product in shopping malls with automatic billing. With the proposed design there is no conventional queue system instead of that automatic billing is generated and hence the shopping becomes easy and enjoyable.

Keywords — ***Smart cart, RFID reader, RFID tags, ZIGBEE***

I. INTRODUCTION

Frequently people encounter a problem of spending too much of their time waiting in queues for billings their purchases in different shopping centers, malls and supermarkets. Waiting in-queues negatively affects human morale and may cause misunderstandings or conflict amongst people for instants,when someone breaks the line and stands infront of other people[2]. The proposed system aims to eliminate this problem by introducing a novel alternative to traditional billing methods, speeding up the payment process.

The Arduino UNO is a microcontroller board.It has on Atmega328 M.C. It contains 14 digital input and output pins. So our aim is to design automatic billing system which is based on RFID(Radio Frequency Identification) technology.

The smart cart uses a serial interface and receives its power from sources like a card reader. A smart card is like a chip card. It is a plastic card that contains an embedded computer chip-either a memory or microcontroller type that store and transacts data. This data usually associated either value, processed within the cards chip. The card data is transacted via a reader that is part of computing system. The smart shopping systems usually require other auxiliary wireless communication systems but the proposed system we are using called as ZIGBEE wireless communication (especially low-cost) to perform indoor positioning and product information broadcasting Thus, the dual-antenna RFID reader is adopted in the developed SSC to identify the items in the cart (internal antenna) and out of the cart (external antenna). A customer when purchases item after swiping card the prize and number of item are read by the RFID reader and the number of items purchased are already entered in to the cart before reaching up to the counter. There will be elimination of queue.

After the card is swiped, the number of items are read by RFID Reader and they are enter into cart before one reach to the counter, queues would be eliminated. Another important technology used in Smart Cart system is called ZIGBEE wireless communication, which is one measure to reduce the waiting time of customer's is to introduce an intelligent billing system using electronic Smart Cart as an alternative to existing barcode system. Smart cart allows a customer to manually perform billing without relying on cashier by means of swiping the RFID tags over RFID reader. Unlike barcode system, smart cart does not need any visual contact with barcodes which may get distorted in real life situations. All data about purchased products and user account data are stored in a cloud database in the Internet. Then, smart cart shows this information to customers on its display.

A customer can delete an item from the list whenever he or she wishes by selecting subtraction button. If the customer decides to finish purchasing, there's a total button press is required to upload all purchased product data and their total cost to billing counter PC through ZIGBEE. Once all payment data is sent to the PC, total cost is withdrawn from the registered account cash of the customer and the customer can freely pass the anti-theft gate with the purchased products.

II. ARCHITECTURE

The technology currently used in checkouts at supermarket is barcodes, which is developed in the1970s .Today barcodes is found on almost every item. Barcodes are a universal technology in that they are the norm for retail products; stores

that own a barcode reader can process barcodes and imprint it on the products. The most important factor that is involved in barcode scanning is that the product should be in the Line of Sight (LOS) of the reader in order to get the barcode imprinted on the product scanned. Thus Shopping in the present day usually involves waiting online to get your items scanned for checkout. During a shopping excursion to a shopping mall, you would have noticed the cashier scanning your products using some Laser device to produce a bill. What actually he is doing that he is reading the product barcodes using a Laser/Barcode scanner. Barcode scanner reads the code, data is sent to the computer, and computer looks up into the database for the price and description of the item[4]. Barcodes are structured to contain specific product related information. It basically encodes alphanumeric characters and symbols using black and white stripes, also called bars. Bar-coding is one of the AIDC (Automatic Identification and Data Collection) technologies.

Some major drawbacks of existing systems are barcode scanners need a direct line of sight to the barcode to be able to read, and in order to read barcodes the scanner needs to be quite closer, Barcodes have no read or write capabilities; they do not contain any information such as expiry date etc. They are very labour intensive, Barcode have less security than RFID, and Barcodes are more easily prone to damages, Waiting in a line to get your items scanned from barcodes in supermarket for checkout is the major drawback.

These drawbacks are overcome by a new system that describes how to build an automated and time saving system for the world of retail which will make shopping experience impetuous, customer friendly and secure[2]. The proposed system uses RFID agent-based architecture that adopts intelligent agent technology with an RFID based applications. RFID provides capability to uniquely identify an object within a supermarket area, while agents are able to establish a channel of communication which can be used to facilitate communications between a RFID device and supermarket back-end system. The proposed framework includes a design of intelligent mobile shopping cart equipped with both RFID and agent technologies. As a result of using the proposed RFID agent based architecture, the customer shopping experience will be improved due to ease of retrieving of the detailed information on items and quick checkout by scanning all items at once, thus eliminating queues. From supermarket management point of view the proposed architecture will reduce the cost of operation e.g., decreasing cost of goods sold which comes in the form of labour efficiency in areas of checkout operation, inventory management and alerting the supermarket management when a certain product is running out of stock and needs to be restocked. The main technological objective for our present solution is the usage of RFID technology for the automatic product identification inside the shopping cart thus eliminating consumer intervention in the process of product reading for payment.

Nowadays, the usage of barcode for product identification presents several limitations. RFID technology is more resistant, safer, identifies products in a unique way, can provide other types of information, can make several simultaneous readings, doesn't need line-of-sight and it has a high range. So that automatic product identification is possible all existing products inside the supermarket need to be identified with RFID tags and each shopping cart must have an RFID reader. The range of the RIFD reader must not extend beyond the horizontal shopping cart limits so that reading products inside other shopping carts or on shelves does not happen. Nevertheless, range cannot be less than the cart's limits with consequence of not identifying products that are inside the shopping cart but out of the reader's range. The RFID reader should be able to read all the tags no matter the material (paper, plastic, metal, etc)they are inserted into. The usage of RFIDs in this solution comprehend benefits such as increasing safety and the consequent reduction in product loss, reduced human intervention and error, increased speed in involved processes, unique identification of products with additional information and availability of real-time information, amongst others.

By using RFID technology there are many advantages like RFID tags can be read from a greater distance than barcodes, RFID tags don't need to be positioned in line of sight with the scanner, RFID tags can be read at faster rate than barcodes, RFID tags are read/write devices, RFID contains high level of security, RFID tags are more reusable, RFID tags carry large data capabilities such as product maintained, shipping history and expiry date etc, and by using this technology bills can be paid very easily and quickly And it also removes the waiting in a line to get the item scanned for checkout.

***16*2 LCD**:*

LCD means Liquid crystal display this means 16 characters per line by 2 lines[1]. The standard is referred as HD44780U, refers to controller chip which receives data from external source and communicates directly with LCD.

***EM-18 READER MODULE**:*

This EM-18 RFID Reader module operates at 125KHZ. An on-chip antenna and can be powered up with a 5V power supply. Power up the module and to receive pin of the microcontroller. The card within the reading distance would be and card number is thrown at the output.

***USE OF RFID**:*

The use of RFID – means radio frequency identification technologies is growing. Many different applications are implemented in various sectors and used for very different purposes. RFID enables wireless data collection by Readers from electronic tags attached to embedded in objects ,for identification and other purposes.

MAX – 232:

The MAX 232 is an integrated circuit created in 1987 by Maxim integrated products. It converts signal from RS-232 serial port to signals. It's a dual transmitter and dual receiver. Typically use Rx , Tx , CTS , RTS signals.

ZIGBEE S2C:

DIG internationally as recently introduced the new Zigbee S2c module. The previous s2 & the transmitted s1 both are discontinued. The new module is powerful with both UART & SPI communication. It utilizes silicon labs EM 375

transceiver. It improves on the transmit power and data protocol which allows you to create complex mesh networks based on the zigbee mesh firmware. The zigbee modules , which means you can plug it on the slandered Arduino, zigbee shield like DF-robot IO expansion shield.

III.WORKING OF THE SYSTEM

In proposed system, one product is attached for identifying the device and it is fit to the trolley. For demo purpose only one trolley and only one device is taken. For billing purpose, there is one billing server at the counter side. The information which needs to be printed in the bill sends through network. Here ZIGBEE is used as the network. At the counter side, billing server gets information which is send by ZIGBEE transmitter. The format of billing or receipt is in application[3]. Application gets executed and it prints bill. The proposed system consists of:

1.Transmitter
2.Receiver
3.Communication between PC and Hardware
4.Billing

1. TRANSMITTER:

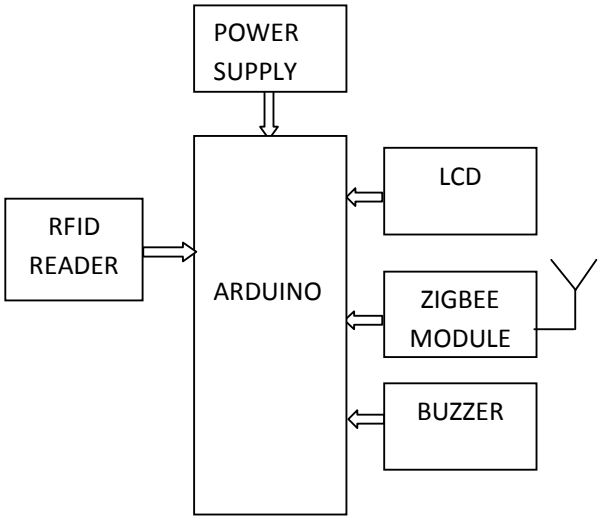

Fig. 1 Block diagram of Transmitter

2. RECEIVER**:**

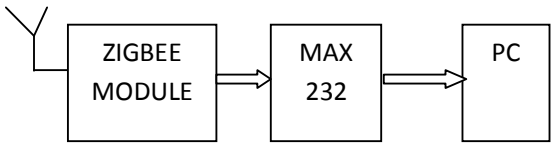

Fig. 2 Block diagram of receiver

3. COMMUNICATION BETWEEN PC AND HARDWARE:

The hardware connections are mentioned in the above figure. As LCD, RFID Reader are interfaced with Arduino.With the help of RFID Reader and ZIGBEE the communication would be developed between PC and hardware.

4. BILLING:

After the above phase i.e., (communication between PC and hardware) the billing of items take place in smart shopping cart. Also total bill would be printed. If any product according to customers wish is not neede d those can be removed and the price of that product gets reduced and bill would be printed.

The working flow of the system is as shown in fig.3:

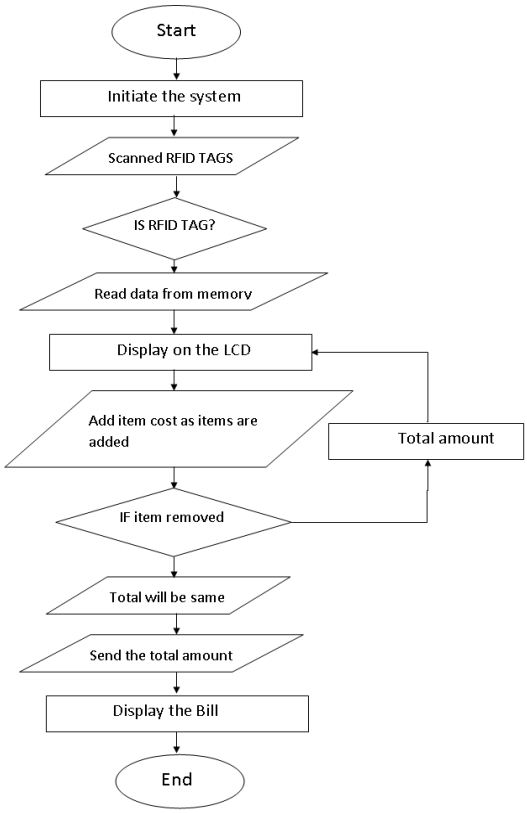

Fig. 3 Flow chart of displaying the bill

IV. RESULTS AND CONCLUSION:

1. Add the product.

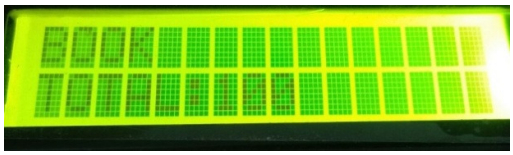

Fig. 4 Adding a prduct

2. Display the item cost**.**

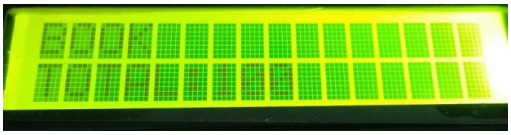

Fig. 5 Displaying the cost.

3.Adding another product

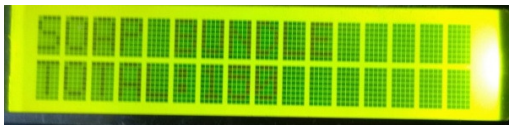

Fig 6 Adding of next product**.**

4. Calculate the total cost.

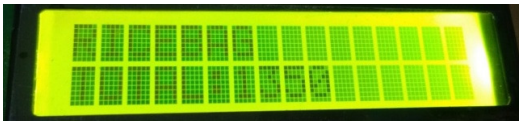

Fig.7 .To calculate the total cost

5. Remove the existing product

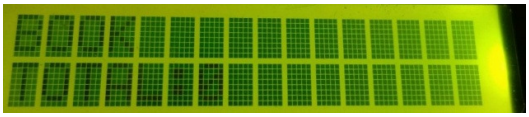

Fig.8 To remove the product

6. Display the bill.

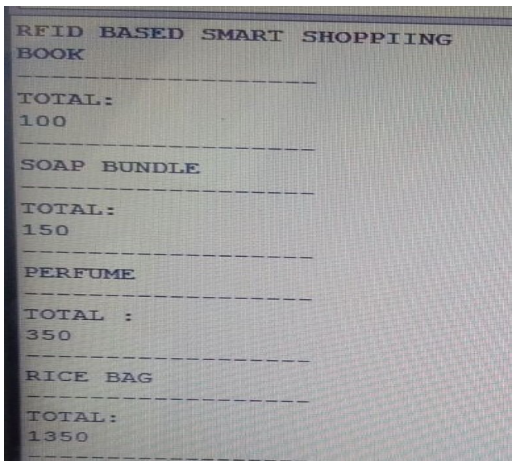

Fig. 9 Total bill.

The above figure shows the product taken and product removed from trolley.

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