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An Intelligent Shopping Cart

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Abstract: ***In this world where technology is reaching new heights every day, the future of every industry, supermarkets and hypermarkets lies in automation. Shopping malls plays an important role as it provides all day to day life products which are essential for our daily life. Every supermarket provides shopping trolleys and baskets in order to assist the customers to carry the products of their interest without incorporation of electronics. Many attempts have been made in order to modernize the shopping experience of the customers.***

The most common problem that is faced by the customers is wasting time in long queues for billing their purchased products. Today's shopping malls use barcode technology for bill generation. Scanning products using Barcode requires perfect line of sight between products and reader which requires lot of time for billing. The main aim of this paper is to present a system that replaces barcode technology with RFID technology as it does not require perfect line of sight to eliminate long queues. The model describe in this paper provides simultaneous billing by displaying total amount of the scanned product on the LCD to know the customer that he/she have sufficient balance to shop further.

Every customer is given a unique RFID card by paying some amount and the customer's account will be created in an android application through which customers can check their wallet balance. At the end of shopping the final bill is transmitted to the billing section through zigbee communication and the net amount will be automatically deducted from the customer's prepaid balance. The proposed model is based on raspberry pi0 processor and uses RFID reader and tags for simultaneous billing, thus solves the problem of long queues.

Keywords: Raspberry pi0 processor, RFID technology, zigbee communication, LCD, shopping trolley

I. INTRODUCTION

In this modern world, every shopping malls are providing shopping trolleys and baskets in order to aid the customers for carrying the products of their interest. In the present shopping scenario the customer needs to drop every item which they intended to by in the shopping trolleys and then allowed to proceed for the billing at the billing counter. The billing process is highly embarrassing and time consuming process which takes lots of time, thereby results in more numbers of billing counters and employees. The technology currently used in checkouts is barcodes.

One of the drawbacks of barcode 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. In 2009, the University of Arkansas Information Technology Research Institute completed a study to determine the business value of RFID. The results shows that overall inventory accuracy improved by more than 27 percent, under stocks decreased by 21 percent, and overstocks decreased by 6 percent. Scanning 10,000 items took two hours using RFID while scanning using barcode took 53 hours.

That means with RFID an average of 4,767 items counted per hour while with barcode only 209 items counted per hour. At present the shopping trolleys which are available in the shopping markets are nothing but just a steel frame with no incorporation of electronics to aid the customers. Lots of attempts have been made in order to modernize the shopping process which includes searching products in less time using web server, but the most common problem experienced by the customers are wasting time in long queues. Therefore it is important to address the most common problem first. This paper describes a model that addresses these issues.

The proposed system uses RFID technology which ensures that customer buys only the necessary products that are really wanted by him, thus it does not exceed the pre determined budged of the customer. As the products are already scanned while shopping, the customers need not to wait in a long queue for billing at the billing counter he can just pay the bill and leave with the items bought. The number of billing counters can be lowered with the proposed smart cart system which in turn leads to lower the number of employees and their costs, the customers are given unique RFID cards in order to ease with the payment process. The model includes raspberry pi0 processor, RFID reader and tags for self scanning of the products, 20x4 LCD for displaying total price of the bought products, keypad for entering password, zigbee for transmitting final bill at the billing section.

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II. LITERATURE SURVEY

Ghatol Sonali Digambar, Mrs.V.S.Jahagirdar, Pratiksha Dattatraya Khamitkar et.al., proposed "SMART SHOPPING USING SMART TROLLEY" this system uses RFID technology and AVR microcontroller, Bluetooth module, 16x2 LCD display. Every product in the supermarket should be tagged with RFID cards .Whenever the customer drops a product into trolley, it will get scanned by RFID reader/Scanner and product price and cost will be displayed on the LCD display. This process is repeated until the customers finish their shopping. Bluetooth module is mounted on the front edge of the trolley. This Bluetooth module is used to transmit the final bill to the main computer.AVR microcontroller is used to store the product detail. Product name, product cost, expiry date etc will be displayed on the LCD display. A switch is used to remove any scanned product from the total bill. This proposed system is time saving and reliable. But the disadvantage of this system is that the size of the microcontroller used in this model is limited to include huge data.

Komal Machhirke, Priyanka Goche, Rupali Rathod et.al., proposed "A New Technology of Smart Shopping Cart using RFID and ZIGBEE". This paper proposed a smart shopping cart which uses the RFID and ZIGBEE technology to identify the products details and sends the data wirelessly to the receiver. This system provides a facility to browse the available products list on-screen in the display connected to the microcontroller which is situated in shopping trolley. 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.

III. PROPOSED DESIGN METHODOLOGY

The proposed system consists of raspberry pi0, RFID reader and tags, 20x4 LCD, zigbee module, keypad, push button and a switch. Raspberry pi0 processor is the main component of this project consisting of 40 GPOI pins. In our proposed model unique RFID card will be given to the customer. The customer can get this card by paying some prepaid amount, customer's own account will be created in an android application which is developed by MIT app inventor and the wallet balance detail is updated on the server. Through an android app customers are able to check their wallet balance detail. Raspberry pi, RFID reader, LCD, Zigbee module and keypad are mounted on the edge of shopping trolley. RFID tags are attached to the every product present in the supermarket. Customers can initiate shopping by tapping the RFID cards that are attached to product against RFID reader. Product name and cost along with total amount will be displayed on the LCD display by pressing the push button in order to confirm the products of interest, which allows the customer to know about their wallet balance and so that they can plan their shopping accordingly. This process is repeated until all products of interest are scanned. At the end of shopping the final bill will be transmitted to the counter section through zigbee module by pressing the switch and the total amount will be deducted from the customer's account which is created using MIT aap inventor. Keypad is used for the customer authentication.

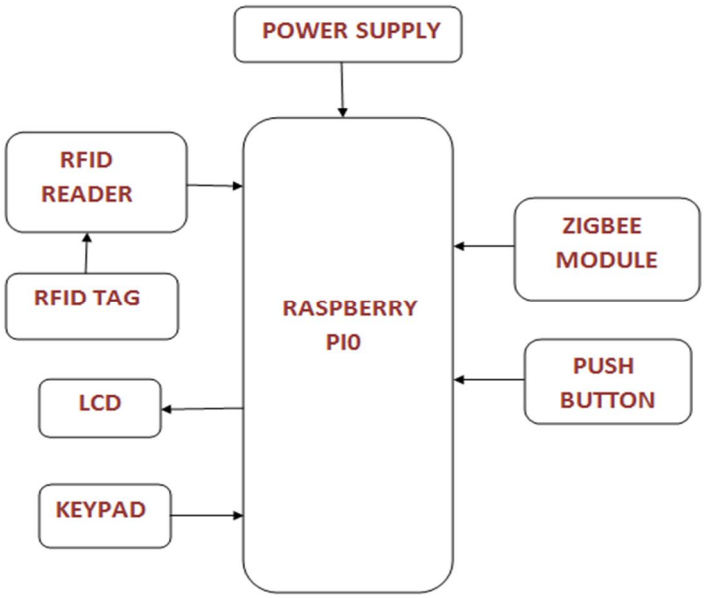

Fig. 1 Block diagram of the proposed system at transmitter end

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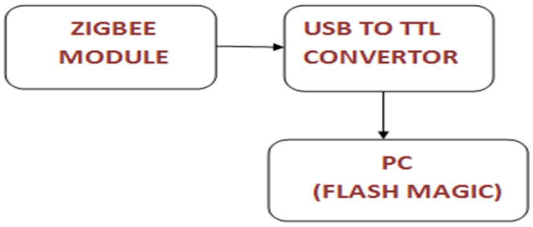

Fig. 2 Block diagram of the proposed system at receiver end

IV. HARDWARE IMPLEMENTATION

A. Power Supply

This model operates on DC power supply, so the 230V AC main power supply must be converted to constant regulated power supply. This is achieved by a step down transformer that converts 230V main AC supply to 12V. Bridge rectifier is used to convert 12V AC into 12V DC, but this is pulsating DC voltage. In order to obtain pure DC voltage a filter is used. Output of the filter is given to the voltage regulator that yields the required pure constant DC voltage.

B. Raspberry pi0 W processor

Raspberry pi is a mini computer having very small size similar to credit card size that is capable of performing almost all functions that your computer does. Raspberry pi0W processor is the heart of this model, providing 40 GPIO pins for interfacing additional devices. Pi0 W operates on 1GHz frequency and 5V power supply. It has single core ARM1176JZFS CPU with 512 MB RAM. This processor is Wi-Fi and Bluetooth enabled that have small size compared to other boards.

C. RFID Reader and Tags

RFID (Radio Frequency Identification & Detection) is the wireless technology based on the principles of magnetic induction that uses radio signals in order to capture, identify and track the objects automatically. RFID tags operate at several different frequencies. The majority of RFID tags operate at either 13 MHZ or 900 MHZ. RFID system comprises of RFID reader and RFID tags. RFID reader is an important element of the RFID system that uses radio waves to read the data received from the tag. RFID reader consists of a microcontroller to process data, RF signal generator which generates continuous radio signals, a signal detector. The different types of RFID reader are fixed RFID reader, handheld RFID reader and integrated RFID reader. A fixed RFID reader stays in one specific position when encoding and reading tags, and handheld RFID reader is mobile and can be passed around while scanning various products. The tags may be active tags, passive tags or semi passive tags. Passive RFID tags are most commonly used as they does not require additional power source while active tags have their own power supply. Tag consists of a controller to process data, memory to store data, transponder which sends feedback signals back to the reader.

D. LCD (Liquid Crystal Display)

In our proposed system 20x4 LCD is used as display unit. The material used in LCD combines the properties of both liquids and crystals. LCD's are lightweight, consume less power, compatible with low power devices and have long duration. Being economical and easily programmable LCD modules are preferred over seven segment LEDs. It has two registers namely command register that stores the command instructions and data register that stores the data to be displayed on the LCD.

E. Keypad

4x3keypad is used in our model with 4 rows and 3 columns. These keypads have ultra thin design, adhesive backing and easy interface to any microcontroller.

F. Zigbee module

Zigbee is wireless communication protocol based on 802.15.4 IEEE standard that operates in PAN (personal area network) with data rate of 250kbps. Basically it is designed for controlling devises and sensors wirelessly. Zigbee operates in three different frequency range of 2.4GHz (support 16 channels) , 915MHz (supports 10 channels), 868MHz (support 1 channel). Zigbee is used as wireless communication in our model as it consumes less power, can be used globally, have long battery life. ZigBee system is useful for Application that needs low data rate.

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G. USB to TTL convertor

USB to TTL convertor is used to convert full duplex USB port into full duplex TTL 5V port. It supports baud rate of 300-115.2KHz and hot pluggable. These convertors does not require external power source as they are port powered. It supports windows 10/8/7/Vista/XP/Server2008/Server2003/2000/98 (32 bit). The USB to TTL convertor is capable of adjusting parity bits, stop bits, baud rate and COM port parameters automatically.

H. Push button

Push button is used in this system to confirm the products that is to be scanned. Push button or simply button is a switch mechanism used for controlling many aspects of a machine. These buttons have three pins namely VCC, GND (ground), digital output.

V. EXPERIMENTAL SETUP AND RESULTS

Fig. 3 Experimental setup of the project

Fig. 4 Initiate shopping

Fig .5 Enter the card password

Fig. 6 Wallet balance detail

Fig .7 Self scanning of products

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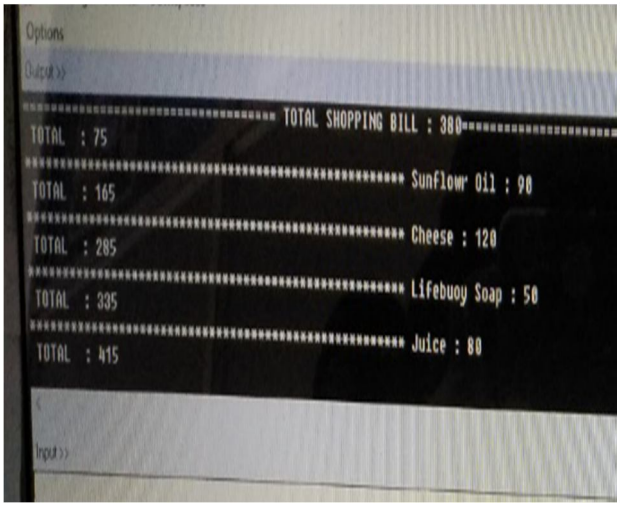

Fig. 8 Displaying total bill at the billing section

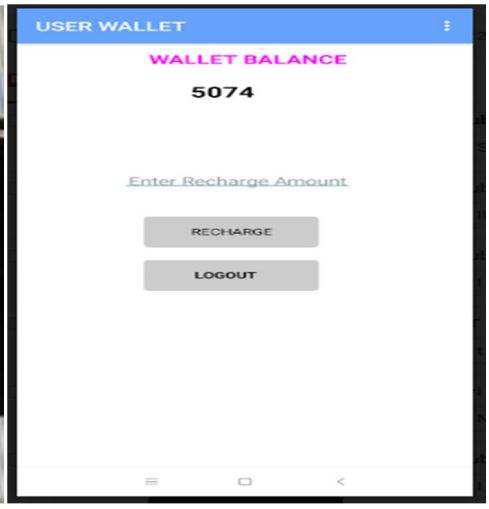

Fig. 9 Checking wallet balance detail through an android app

VI. RESULTS

It is evident that with the use of this system the waiting time in long queues for billing has been reduced as it provides concurrent billing. The proposed model speed up the entire process of shopping by replacing existing barcode readers with the RFID technology as a perfect line of sight is not needed to scan the items of interest. LCD displays total amount to be paid simultaneously during shopping itself which allows the customers to plan their shopping. With this system the number of billing counters and hence the number of employs has been greatly reduced.

VII. CONCLUSION

The proposed system is a smart approach towards modernizing the current shopping process and revolutionized the entire way of shopping. All the hardware and software components designed and implemented successfully. The traditional barcode system has been replaced by the RFID technology which solves the most common problems faced by the customer that is wasting time in long queues for billing, overshooting budget and extra billing counters. The system provides simultaneous billing by self scanning of the products and hassle free payment by automatic deduction of final amount from customer's account.

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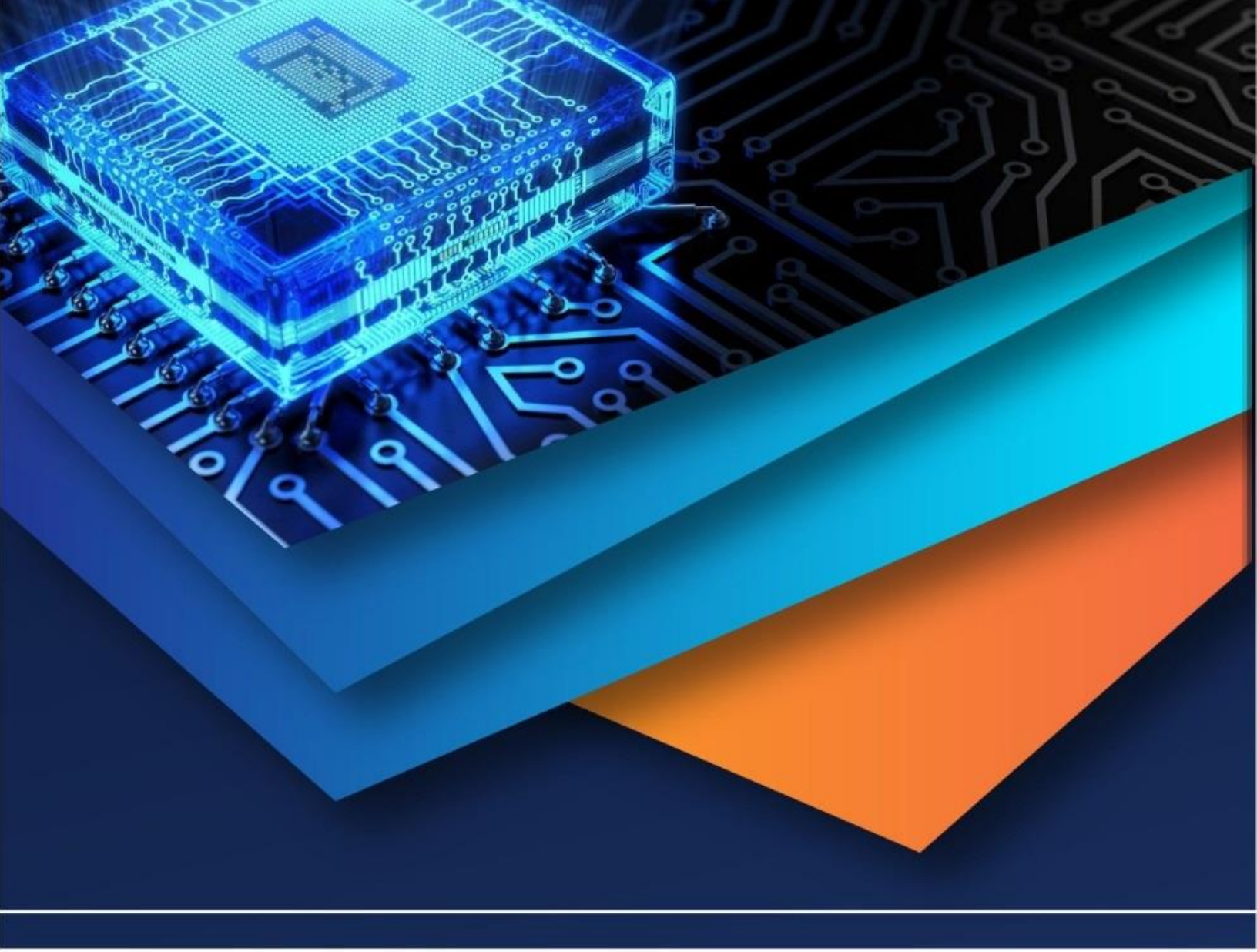

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