RFID Based Automatic Billing Trolley

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Abstract - **Now days purchasing and shopping at big malls is becoming a daily activity in metro cities. We can see huge rush at malls on holidays and weekends. The rush is even more when there are special offers and discount. People purchase different items and put them in trolley. After total purchase one needs to go to billing counter for payments. At the billing counter the cashier prepare the bill using bar code reader which is a time consuming process and results in long queues at billing counters. Our aim is to develop a system that can be used in shopping malls to solve the above mentioned challenge. The system will be placed in all the trolleys. It will consist of a RFID reader. All the products in the mall will be equipped with RFID tags. When a person puts any products in the trolley, its code will be detected and the price of those products will be stored in memory. As we put the products, the costs will get added to total bill. Thus the billing will be done in the trolley itself. Item name and its cost will be displayed on LCD. Also the products name and its cost can be announced using headset. At the billing Counter the total bill data will be transferred to PC by wireless RF modules.**

*Index terms*- **RFID reader, RFID tags, wireless RF modules, IR rays**

I. INTRODUCTION

Shopping mall is a place where people get their daily necessities ranging from food products, clothing, electrical appliances etc.

Now day's numbers of large as well as small shopping malls has increased throughout the global due to increasing public demand & spending. Sometimes customers have problems regarding the incomplete information about the product on sale and waste of unnecessary time at the billing counters. Continuous improvement is required in the traditional billing system to improve the quality of shopping experience to the customers.

To overcome these problems stated above and to improve the existing system, we have designed a SMART TROLLEY USING RFID. This can be done by simply attaching RFID tags to the products and a RFID reader with a LCD display on the shopping trolley. With this system customer will have the information about price of every item that are scanned in, total price of the item and also brief about the product. This system will save time of customers and manpower required in mall and cost associated with the product.

II. SYSTEM DIAGRAM
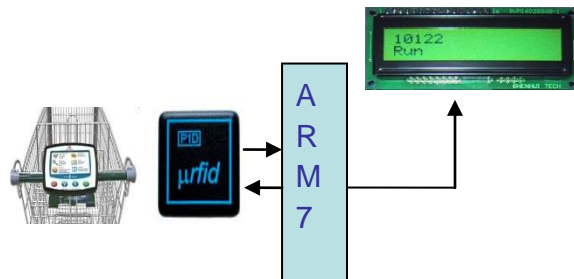
III. BLOCK DIAGRAM

a) Trolley unit
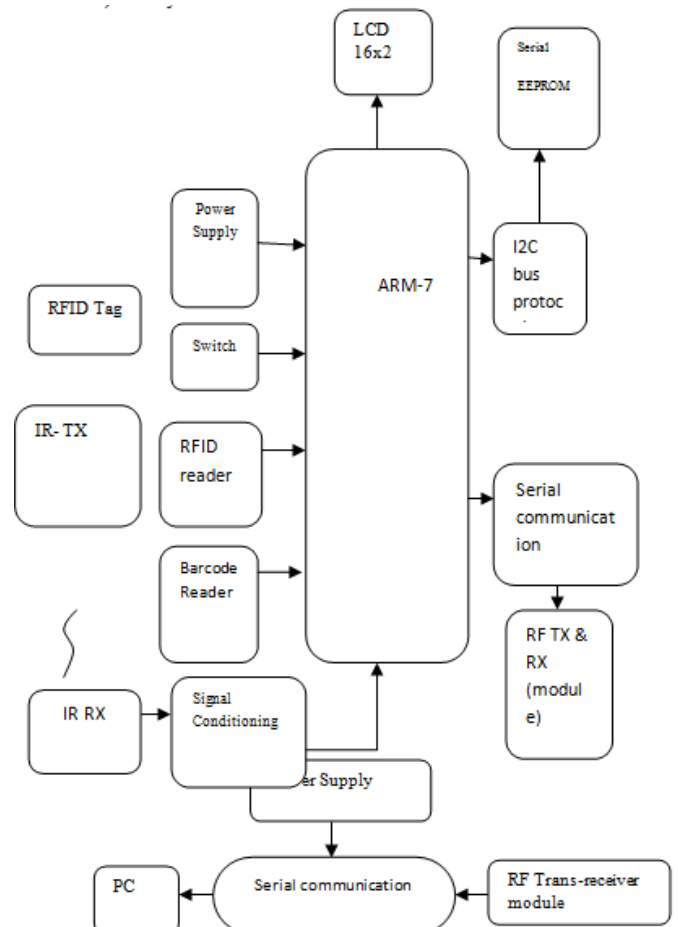
IV. HARDWARE USED

Trolly Unit

In this unit the ARM processor is attached to a RFID reader and barcode reader. As the user puts the items in the trolley the reader on the trolley reads the tag and sends a signal to the ARM processor. The ARM processor then stores it in the memory and compares it with the lookup table. If it matches then it shows the name of item on LCD &also the total amount of items purchased.

Billing Unit

As soon as the shopping is over the user comes near the billing section .The total bill will display on the billing computer.

Power Supply

The AC supply is applied to 12V step down transformer. The transformer output is the 12V AC which is rectified using a diode bridge. The output of Diode Bridge of 12V DC is filtered by capacitors.

RFID Tags

Tags are of two types: passive tags which have no battery life and active tags which have battery life. RFID tags released for automatically identifying a person, a package or an items. These are transponders that transmit information. RFID tag contains two parts. One is integrated circuit for modulating, storing and processing information and demodulating radio frequency (RF) signal. The second is an antenna for receiving and transmitting signal.

RFID Reader

RFID reader consists of an RF module that acts as a transmitter and receiver of radio frequency signal. Transmitter consists of an oscillator to create the carrier frequency; a modulator to make impact on data commands upon this carrier signal & a receiver that contains demodulator to extract the data returned.

Barcode Reader

A barcode reader is used to read printed barcodes. All barcode readers consists of decoder circuitry for analyze the barcode's image data and sending the barcode's content to the output port of scanner.

IR Sensor

IR sensor is used for detecting a select light wavelength in the infra-red (IR) spectrum by using a specific light sensor. In IR sensor, LED is used that produces light at the same wavelength as what the sensor looking for.

When an object is brought close to the sensor, the light from the LED reflects from the object and bounces into the light sensor.

LCD Display

LCD has the ability to display numbers, characters & graphics. The display is interfaced to I/O port of micro controller (P0.0-P0.7). The display is in multiplexed mode i.e. only one display remains on at a time. Within $1/10^{th}$ of a second the next display switches on. In this way sequentially on and off display will result in continuous display of count due to persistence of Vision.

RF Module

RF module consists of RF transmitter and RF receiver. It is a small electronic circuit used to transmit and receive radio signal. It selects one out of a number of carrier frequencies. Types of RF module are:

1) Transmitter module
2) Receiver module
3) Tran receiver module

In this project we have used Tran receiver type RF module. It is a small PCB sub assembly and is capable of transmitting and modulating a radio wave that carries data. Transmitter modules are implemented alongside a micro controller which will provide data that can be transmitted to the module.

V. SOFTWARE DESCRIPTION

The software consists of two segments

1. Embedded c that is used by the hardware that is RFID receiver (fitted in trolley) and transmitter (RFID tags) that look ups up the specified table of item and maps the product with price.
2. VB is used on the front end to display the final billed amount to the customer on both the display on the trolley and display exit where the final payment is made.

VB has to ensure simpler user interface and embedded C must ensure accurate billing.

VI. DETAIL DESCRIPTION OF SYSTEM

The detail description of proposed system is explained in the next sub section.

A) Features of RFID based trolley

- Bill calculation at trolley itself.
- Low chance of traffic & mismanagement.
- Reduction in support staff.

• No more queue for billing hence real customer satisfaction.

B) How System Works

A customer enters into a shopping mall. On entering, she/he first picks up a trolley. Each trolley is associated with a RFID reader and a barcode reader. A typical trolley is shown in Figure 1. The functioning of the system is explaining below:

• When the customer purchase a product, she/he first scans the RF tag of the product using the RFID reader and then places it into the trolley .While the customer is scanning the RF tag of the product, a price of the product is taken and stored in the system's memory.

• Information stored in system's memory is compared with the lookup table. If matches are found then cost, name of respective product gets displayed on the LCD. At the same time ARM processor sends the same information to computer for billing purpose with the help of RS232 protocol.

• Here we have used IR sensor for counting purpose. This works as the IR sensor continuously emits IR rays. If we put a product in a trolley ant at that time there is obstacle for IR rays, then it would result in interruption in counting of products in trolley. This recorded data is stored in arm processor.

• Counting is mainly done for security purpose. If in case while wandering round the mall someone removes the RFID tag and puts the product in trolley then counting the no of items helps to get information of items purchased. Thus counting is done but there is no addition of cost respective product in bill. This shows the increase in number of products but not increase in bill.

• If an unwanted product is removed from trolley then it decreases the number of products as well as bill. Double entry of product deletes the product name with respective to cost of product.

• After completion of shopping, a key is pressed indicating final billing of all the products. Thus the final information of all products is transmitted to a computer with the help of serial communication & the final billing is done by VB software on computer.

• There is a barcode system in our project. It is impossible to stick the RFID tag to some product like coconut, vegetables etc. Hence in such cases conventional scanning of barcode is more sophisticated than RFID technique.

VII. ALGORITHM

Step1: Start

Step2: Initialize System

Step3: search for RFID

Step4: check RFID tag

Step5: Read related data from memory

Step6: Display data on LCD

Step7: Add item cost as items are added

Step8: When upload key is pressed send data to the counter

Step9: Print the Bill

Step10: Stop
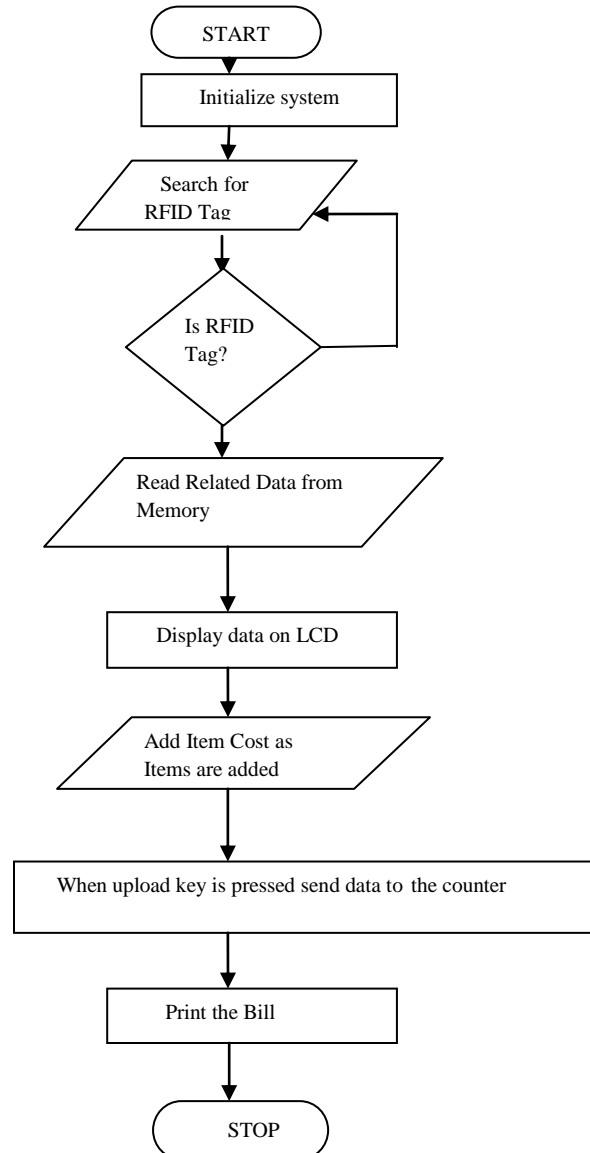
VIII. RESULT AND ANALYSIS

1. The utility of trolley will be first of its kind for commercial use.
2. This device records the data of the different products with help of the suitable sensors like RFID Tags.
3. This recorded data helps the shop owner with detailed analysis of shopping by the customer & there preferences through the computer; printout of the same can be obtained.

IX. CONCLUSION

By means of this paper we intent to simplify the billing process, make it swift & increase the security using RFID technique. This will take the overall shopping experience to a different level.

Different parameters such as the system parameters of smart trolley like products name, products cost, product weight etc. are continuously display

Thus with the help of the conclusion we can say that-

1. Automatic billing of products by using RFID technique will be a more viable option in the future.
2. The system based on RFID technique is efficient, compact and shows promising performance.

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