RFID Based Smart Trolley with Automatic Billing System Using Zigbee

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Abstract – In this research work, we discuss a concept of RFID (Radio Frequency Identification) which is used to implement an Smart Trolley With Automatic Billing System Using Zigbee. Problem faced by the customers while shopping in mall is simply waste of their time while standing in long queues at the billing counter to scan the each and every product. The RFID system will be placed in all the trolleys in the malls. It contains the RFID reader. All the products in the mall will be attached with RFID tag. When a person puts any product in the trolley, its code will be detected and the price of those products will be stored in memory. As we put on the products the cost will get added into total bill. Thus the billing will done in the trolley itself. Finally at the main billing counter contain the total billing information.

Keywords: Radio Frequency Identification, Electronic Services, Wireless Zigbee Module, Grocery Stores, Server database

I. INTRODUCTION

The proposed system is used in shopping malls. Shopping mall is a place where people get their daily necessities ranging from food products, clothing, home 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 i.e. description of 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 RFID BASED SMART TROLLEY. 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.

Fig.1: A Trolley is attached with the RFID reader and LCD.

As shown in the above figure RFID reader which is attached to the trolley will make the automatic billing of all the products when we put the products into the trolley.

The organization of research work is as follows;

section I deals with the introduction of this research work and also drawbacks of existing system. In section II it deals with the materials and methodology of the system which gives the information of the hardware components used. In section III it deals with the related works that will give brief explanation of RFID where it is used. In section I deals with automated billing trolley which will give information about how trolley works in malls. In section V explains future scope and conclusion with references.

II. MATERIALS AND METHODOLOGY

In recent years, radio frequency identification technology has moved from obscurity into mainstream applications that help speed the handling of manufactured goods and materials. RFID enables identification from a distance and unlike earlier bar-code technology; it does so without requiring a line of sight. RFID tags support a larger set of unique IDs than bar codes and can incorporate additional data such as manufacturer, RFID systems can discern many different tags located in the same general area without human assistance.

Radio frequency identification (RFID) is a general term that is used to describe a system that transmits the identity(in the form of a unique serial number) of an object wirelessly using radio waves .

A RFID tag.

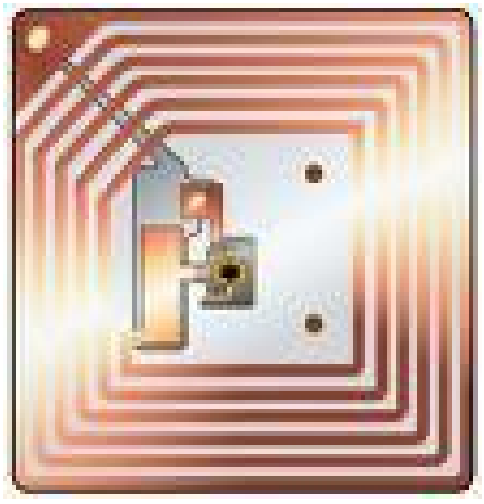

Fig. 2: RFID tag

Many types of RFID exist, but at the highest level, we can divide RFID devices into two classes: Active and passive. 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.

B BRFID frequencies

Much like tuning in to the favorite radio station, RFID tags and readers must be tuned into the same frequency to enable communications. RFID systems can use a variety of frequencies to communicate, but because radio waves work and act different frequencies, a frequency for specific RFID system is often dependent on its application. High frequency RFID systems (850 MHz to 950 MHz and 2.3 GHz to 2.5GHz) offer transmission ranges of more than 90 feet, although wavelengths in the
2.3 GHz range are absorbed by water, which includes the Human body and therefore has limitations.

C ZigBee

ZigBee is an IEEE 802.15.3 standard for data communication with business and consumer devices. It is designed around low-power consumption allowing batteries to essentially last forever. The ZigBee standard provides a network, security and application support services operating on top of the IEEE 802.15.3 Medium Access Control (MAC) and physical layer wireless standard. It employs a suite of technologies to enable scalable, self-organizing, self-healing networks that can manage various data traffic patterns.

ZigBee is a low-cost, low-power, wireless mesh networking standard. the low-cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power- usage allows longer life with smaller batteries and the mesh networking provides high reliability and larger range. ZigBee has been developed to meet the growing demand for capable wireless low power devices. In industry, ZigBee is being used for next generation automated manufacturing, with small transmitters in every device on the floor, allowing for communication between devices to a central computer. This new level of communication permits finely tuned remote monitoring and manipulation.

Fig 3: ZigBee

D Microcontroller

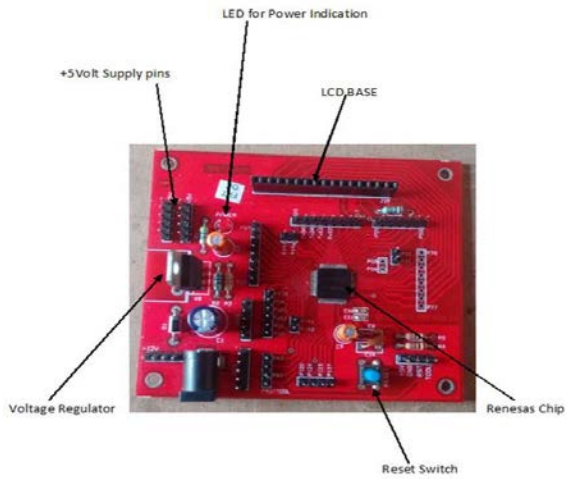

Fig 4. 64 pin renesas microcontroller board

A microcontroller is a computer present in a single integrated circuit which is dedicated to perform one task and execute one specific application. It contains memory, programmable input/output peripherals as well a processor.

Features of microcontroller

• General-purpose register: 8 bits × 32 registers (8 bits × 8 registers × 4 banks)

• ROM: 512 KB, RAM: 32 KB, Data flash memory: 8 KB

• On-chip high-speed on-chip oscillator

• On-chip single-power-supply flash memory (with prohibition of block erase/writing function)

E LCD (Liquid Crystal Display)

Fig 5. LCD

LCD Is a Flat Panel Display, electronic visual display, based on on liquid crystal technology. A liquid crystal display consists of an array of tiny segments (called pixels) that can be manipulated to present information. Liquid crystals do not emit light directly instead they use light modulating techniques.

F Driver Circuit

A driver circuit is an electrical circuit or other electronic component used to control another circuit or component, such as high power transistor, liquid crystal display (LCD).Driver circuits are most commonly used to amplify signals from controller or microcontroller in order to control power switches in semiconductor devices.

III. RELATED WORK

IV.

RFID means Radio frequency identification i.e. the technology that uses radio waves to automatically identify individual items. The objective of any RFID system is to carry data in suitable transponders, generally known as tags and to retrieve data; RFID is one of the most technologies being adopted by both industry and academic world. Thus in sections we specifying the role of RFID in many applications such as:

A. RFID LIBRARY MANAGEMENT SYSTEM

RFID library management, using RFID tags library, is easy and convenient. A RFID library management system consists of books, each attached with an RFID tag, RFID reader, computer network and software.

Library staff handle lending, returning, sorting, tagging etc. of books, using RFID tags in this library system. A person can locate RFID library books marked with a RFID tags, using the RFID reader which identifies and locates the book. RFID library management saves a book reader, precious time that he would have been spent, waiting for his turn in a queue for borrowing or returning a book. Borrowing and returning of books can be fully automatized with the help of self check in/out systems. Books selected by the person are identified by the system's built-in RFID reader. And, the surveillance bit in the book's tag is deactivated by the system. When a book is returned, the check-in/out system activates the surveillance bit.

B. SECURITY USING RFID

Security and personal identification applications are a major and broad application of RFID. A common use of RFID is in identification cards to control building access. Many organizations use RFID tags embedded in ID cards, which are readable at a building entrance. On a similar note, some credit cards (AmericanExpress'ExpressPay,http://www.americanexpress.com/expresspay) and other payment devices, such as ExxonMobil's Speed pass (http://www.speedpass.com), use RFID tags. Other cards use tags for automatic fare payment in mass-transit systems, such as the Smart trip card for the Washington DCarea subway and bus system (http://www.wmata.com/riding/smartrip.cfm).

C. BANKING LOCKER SYSTEM

This research work describes Banking Locker Security system with order identification Security Questions using RFID technology which can be used in banks, companies and at personal secured places. Only original account holder is able to use his locker. This system uses Odor identification Security question technique, RFID technology which makes it more secured than any other system. The system is more secured as 4 steps are required for verification. RFID tag is verified using RFID technology, then valid person has to answer the security question using Security question software technique and it should be same as that of stored (initially during account opening),then the valid person gets message in his mobile using GSM technology and has to type password from his mobile and keypad of locker, both passwords should match to open the door of the locker, and then order identification will be done, the order pattern should match with the order pattern stored in the microcontroller.

D. TRACKING SYSTEM FOR STUDENT'S SAFETY

The student's safety and security is a challenging task for the school management as well as parents or guardians' responsibility. Regarding the students' behavior and safety, the school management and teachers are facing significant challenges to introduce the security within the educative environments. Children and school bus location can be easily traced. Also the bus speed can be controlled while continuously monitoring the activities inside the school bus. So far the satisfaction of the parents, teachers and school staff, tracking and identification can be achieved through the latest communication technology such as RFID systems .

V. AUTOMATED BILLING TROLLEY

In this section we discuss about the working of proposed system. When a customer enters into a shopping mall. On entering, she/he first picks up a trolley. Each trolley is attached with a RFID reader. A trolley is shown in Fig. The system function is explained below:

When the customer purchase a product or a item, she/he first scans the RFID tag of the product using the RFID reader and then the customer put the product into the trolley .While the customer is scanning the RFID tag of the product, a name, price of the product is taken and stored in the system's memory. Information of the product stored in system's memory is compared with the lookup table. If both information are same then name, price, number of items and other description of respective product gets displayed on the LCD. At the same time Zigbee module sends the same information to computer for billing purpose at the main billing counter. Here we have used IR sensor for

counting purpose. This IR sensor emits IR rays continuously. If we put a product in a trolley and at the same 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 someone removes the RFID tag of the product 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 we don't want the product, we can removed that product from the trolley then it decreases the number of products and decrease in the price of the products. Double entry of product deletes the product name with respective to cost of product.

After completion of the customer's shopping, a button should be pressed which indicates the final billing of all the products. Thus the final information of all products is transmitted to a computer at the main billing counter 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.

VI.SYSTEM ARCHITECTURE

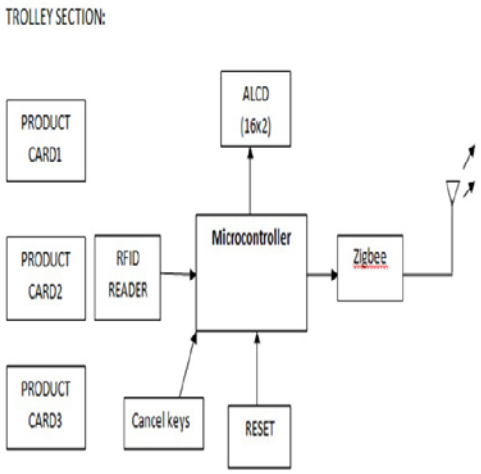

Fig.6: TROLLEY SECTION

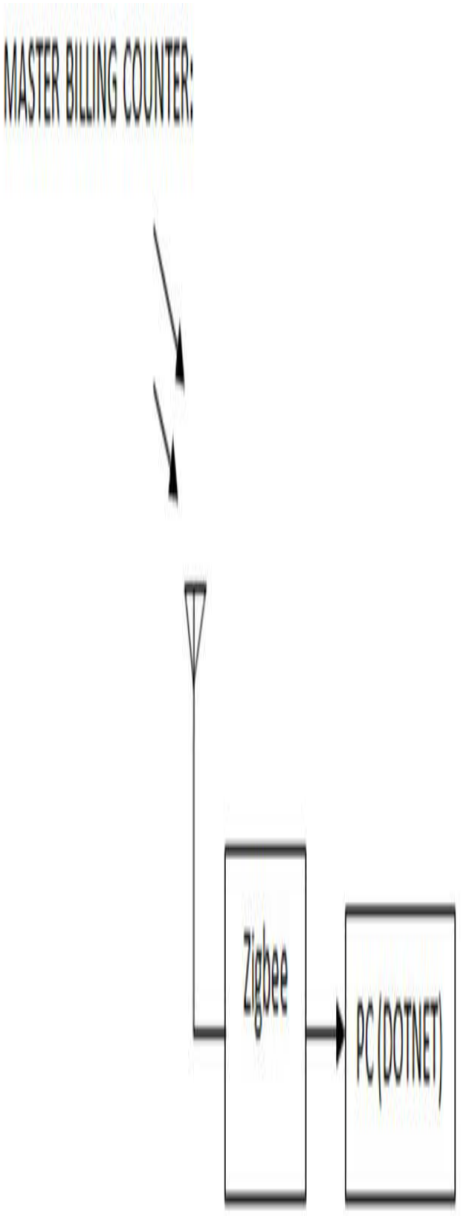

FIG.7: MASTER BILLING COUNTER

A. 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

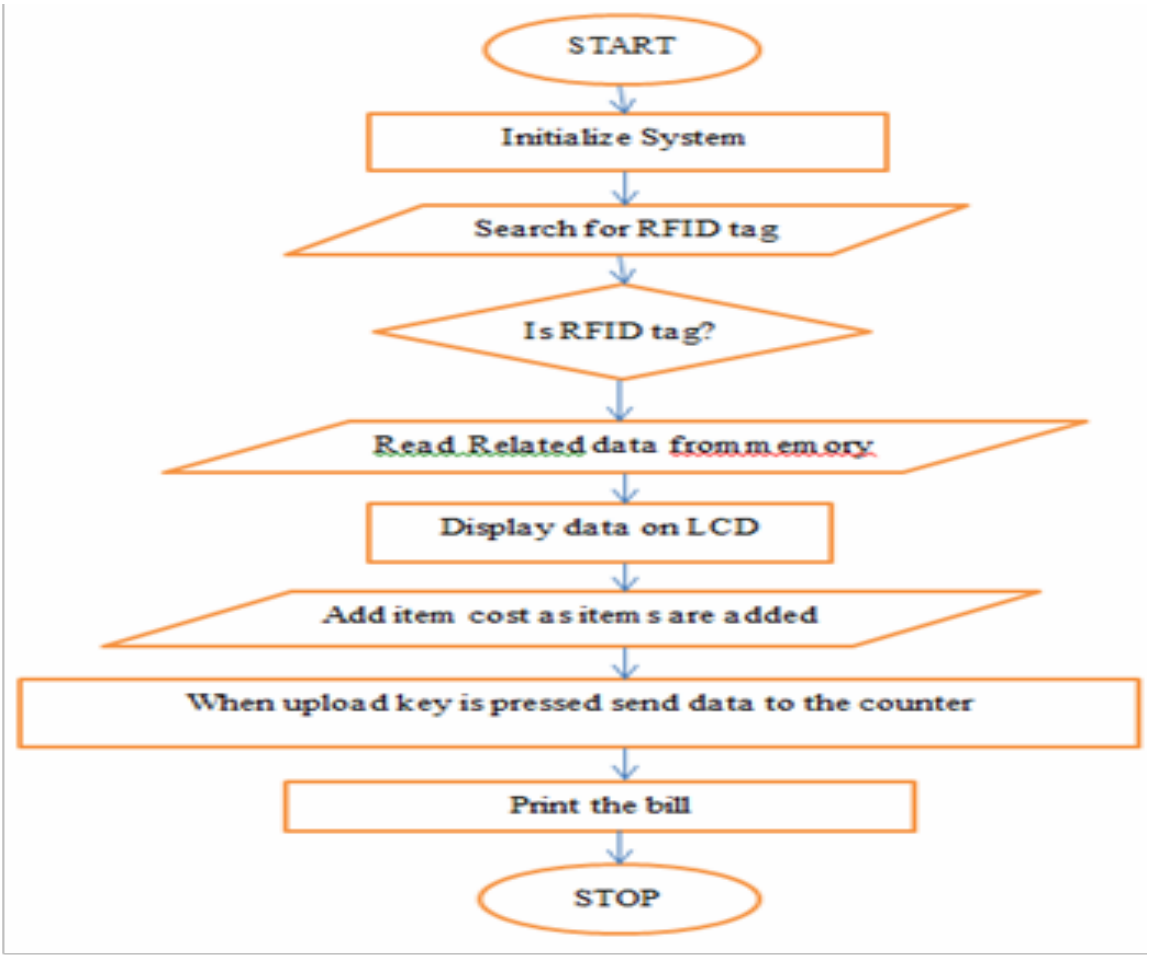

Fig.7: FLOWCHART

VII. CONCLUSION AND FUTURE SCOPE

This application simplifies the billing process, make it easier & increase the security by using RFID technology.

Description of products such as item name, item cost, item weight, I tem manufacture date, expired date etc. are continuously display in the LCD. This will take the overall shopping experience to a different level. Thus with the help of the conclusion we can say that automatic billing of products by using RFID technique will be a more viable option in the future. Easy shopping in the malls to save time, energy and money of the consumers. The system based on RFID technique is efficient, compact and shows promising performance. In future, a more sophisticated microcontroller, larger display system can be used to track the product, internet facility inside the card to browse the offers, deals and facility of payment within the cart by using swapping. card can be used to make cart more advance and provide better consumer experience. Smart cart can be interfaced with wireless technologies to make it completely portable in the near future. Payment of bills using mobile can be implemented. A low cost RFID scanner can be

manufactured and used which can scan multiple tags (products) simultaneously for faster processing and lesser resources. Pay scheduling feature will be the latest trend in upcoming years due to the boost in the e-commerce industry.

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