Developing a Multitasking Shopping Trolley Based On RFID Technology

Satish Kamble, Sachin Meshram, Rahul Thokal, Roshan Gakre

Abstract*— RFID (radiofrequency identification) technology offers the ability to provide many new services and conveniences in the retail environment. An innovative product with societal acceptance is the one that aids the comfort, convenience and efficiency in everyday life. Purchasing and shopping at big malls is becoming daily activity in various cities. We can see big rush at these malls on holidays and weekends. People purchase different items and put them in trolley. After completion of purchases, one needs to go to billing counter for payments. At billing counter the cashier prepare the bill using bar code reader which is very time consuming process and results in long queue at billing counter. In this paper, we discuss a product "Developing a Multitasking Shopping Trolley Based On RFID Technology" being developed to assist a person in everyday shopping in terms of reduced time spent while purchasing. The main objective of proposed system is to provide a technology oriented, low-cost, easily scalable, and rugged system for assisting shopping in person. The developed system consists of 3 key components/modules (a) Server Communication component (SCC) (b) User Interface and display component (UIDC), and (c) Automatic billing component (ABC). SCC establishes and maintains the connection of the shopping cart with the main server. UIDC provides the user interface and ABC handles the billing in association with the SCC. These 3 modules are integrated into an embedded system and are tested to satisfy the functionality. Smart shopping carts with electronic displays, in communication with a computer system, can display an overall description with cost details associated with a Shopping list Databases. Smart cart, also equipped with RFID tags, can also verify the Purchase of the items as they are placed in the cart and, if desired, communicate with a billing system to automatically bill the shopper for the purchases.

Index Terms*— RFID Reader, RFID Tag, Shopping Trolley, VB.Net, Embedded 'C', Workstation.

I. INTRODUCTION

RFID tags, or simply "tags", are small transponders that respond to queries from a reader by wirelessly transmitting a serial number or similar identifier. They are heavily used to track items in production environments and to label items in supermarkets. They are usually thought of as an advanced barcode. However, their possible area of use is much larger. This paper presents a few new applications that are possible using RFID technology such as locating lost items, tracking moving objects, and others.

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Satish Kamble, Information Technology, Rajiv Gandhi College of Engineering Research, Nagpur, India.
Sachin Meshram, Information Technology, Rajiv Gandhi College of Engineering Research, Nagpur, India.
Rahul Thokal, Information Technology, Rajiv Gandhi College of Engineering Research, Nagpur, India.
Roshan Gakre, Information Technology, Rajiv Gandhi College of Engineering Research, Nagpur, India.

RFID tags are expected to proliferate into the billions over the next few years and yet, they are simply treated the same way as barcodes without considering the impact that this advanced technology has on privacy. This paper presents possible exploits of RFID systems and some proposed solutions as well.

RFID is the special type wireless card which has inbuilt the embedded chip along with loop antenna. The inbuilt embedded chip represents the 12 digit card number. RFID reader is the circuit which generates 125KHZ magnetic signal. This magnetic signal is transmitted by the loop antenna connected along with this circuit which is used to read the RFID card number. In this project RFID card is used as security access card. So each product has the individual RFID card which represents the product name. RFID reader is interfaced with microcontroller. Here the microcontroller is the flash type reprogrammable microcontroller in which we already programmed with card number. The microcontroller is interfaced with keypad.

A. Related Work

While doing survey we found that most of the people prefer to leave the shopping mall instead of waiting in long queues to buy a few products. People find it difficult to locate the product they wanted to buy, after selecting product they need to stand in a long queue for billing and payment. To try to solve the problems previously identified, recent years have seen the appearance of several technological solutions for hypermarket assistance. All such solutions share the same objectives: save consumers time and money, help the retailers to win loyal clients. Satoru Uehara defined the Web shopping cart system as a typical client-server application on the Web. Then they clarified several problems on the implementation of the Web shopping cart system, which are peculiar to the Web. In order to solve the problems. He proposed a new mechanism that can manage user sessions with high reliability and safety. He compared the Web shopping cart system implemented using the proposed mechanism with the one developed by the conventional methods. Chihhsiong Shih proposed an automatic embedded software generation framework that can create and evolve Zigbee applications. The framework consists of two major modules, pattern extraction and code generation. Pattern extraction and development are designed to provide Zigbee application with model reuse and modification. SysML serves as a medium between pattern development and code generation. State diagrams, class diagrams and sequence diagram help describes a specific application scenario. A smart shopping cart application has been implemented using this pattern based software framework.

B. Nature of the Problem:-

When any selected product is dropped in into the cart, RFID reader the reads the tag inside the product and the information of the product is extracted and displayed on the LCD screen. At the same time billing information is also updated. The working of the Intelligent Shopping Cart can be explained with the following steps:

1) When shoppers with the cart press "start button" the system turns ON and then all the components such as RFID reader, microcontroller and physical media start working.
2) Every product has an RFID tag which contains unique id. These Ids's are fed in the database assigned to the corresponding products.
3) When the shopper drops any product in the cart then the RFID reader reads the tag. The information of the product is extracted and displayed on the LCD screen. At the same time billing information is also updated.
4) These steps are repeated until the end of shopping button is pressed. Once the "End Shopping" button is pressed the total bill is send to master pc.
5) There is also a option provided to delete some of the products from the cart and the bill will be updated accordingly, This goes by the customer choice.
6) At the end of shopping, the customer can straight away pay the bill and leave.
7) Inventory status of the products is also updated at the end of shopping.

C. Previous work: -

Nowadays, if a consumer would like to buy something at a shopping mall, consumers need to take the particular items from the display shelf and then queue up and wait for their turn to make payment. Problem will surely arise when the size of a shopping mall is relatively huge and sometimes consumers don't even know where certain items are placed. Besides, consumers also need to queue for a long time at the cashier to wait for turn to make payment. The time taken for consumers to wait for the customers in front of the queue to scan every single item and then followed by making payment will definitely take plenty of time. This condition will surely become worst during the season of big sales or if the shopping mall still uses the conventional way to key in the price of every item by hand to the cash register. On the other hand, consumers often have to worry about plenty of things when going to the shopping mall.

For example, most consumers will worry the amount of money brought is not enough to pay for all the things that wanted to be bought until it comes to our turn to pay at the cashier, consumers might also worry that whether certain food product available at the shopping mall or not, or suitable for vegetarian since most of the food product might not be stated clearly.

It will be a great convenience if the information of items that are available in the shopping mall can be obtained. It will be a great improvement on the existing system if the technology of RFID is implemented. Consumers will be able to get information of all the items at shopping mall, total up the prices of items as they shop, and save unnecessary time at the cashier.

II. LITERATURE SURVEY

Nowadays, if a consumer would like to buy something at a shopping mall, consumers need to take the particular items from the display shelf and then queue up and wait for their turn to make payment. Problem will surely arise when the size of a shopping mall is relatively huge and sometimes consumers don't even know where certain items are placed. Besides, consumers also need to queue for a long time at the cashier to wait for turn to make payment. The time taken for consumers to wait for the customers in front of the queue to scan every single item and then followed by making payment will definitely take plenty of time.

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III. COMPONENTS OF RFID

A basic RFID system consists of three components:-

1. An antenna or coil
2. A transceiver (with decoder)
3. A transponder (RF tag) electronically programmed with unique information.

These are described below:

A. Antenna:-

The antenna emits radio signals to activate the tag and read and write data to it. Antennas are the conduits between the tag and the transceiver, which controls the system's data acquisition and communication. Antennas are available in a variety of shapes and sizes; they can be built into a door frame to receive tag data from persons or things passing through the door, or mounted on an interstate tollbooth to monitor traffic passing by on a freeway. The electromagnetic field produced by an antenna can be constantly present when multiple tags are expected continually. If constant interrogation is not required, a sensor device can activate the field.

Often the antenna is packaged with the transceiver and decoder.

The reader emits radio waves in ranges of anywhere from one inch to 100 feet or more, depending upon its power output and the radio frequency used. When an RFID tag Passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer for processing.

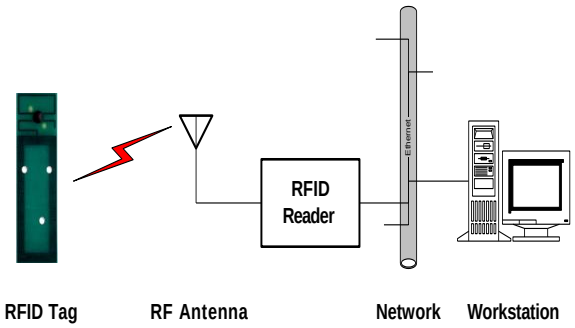


Fig.1 Working of an RFID Tag Antenna

B. RFID transponders (tags):-

Consist in general ofMicro chip Antenna Case Battery (for active tags only) the size of the chip depends mostly on the Antenna. Its size and form is dependent on the frequency the tag is using. The size of a tag also depends on its area of use. It can range from less than a millimeter for implants to the size of a book in container logistic. In addition to the micro chip, some tags also have rewritable memory attached where the tag can store updates between reading cycles or new data like serial numbers. The antenna is clearly visible as said before the antenna has the largest impact of the size of the tag. The microchip is visible in the center of the tag, and since this is a passive tag it does not have an internal power source.

C. RFID tag:-

A radio-frequency identification system uses *tags*, or *labels* attached to the objects to be identified. Two-way radio transmitter-receivers called *interrogators* or *readers* send a signal to the tag and read its response.

Fig. RFID Tag

RFID tags can be either passive, active or battery assisted passive. An active tag has an on-board battery and periodically transmits its ID signal. A battery assisted passive (BAP) has a small battery on board and is activated when in the presence of a RFID reader. A passive tag is cheaper and smaller because it has no battery.

Tags may either be read-only, having a factory-assigned serial number that is used as a key into a database, or may be read/write, where object-specific data can be written into the tag by the system user. Field programmable tags may be write-once, read-multiple; "blank" tags may be written with an electronic product code by the user.

An RFID system is specifically designed to be asymmetric the reader is big, expensive and power hungry compared to the RFID tag. There are a number of different types of RFID system, but one basic categorization is based on the power source used by the tag Passive tag RFID systems require no power source at the tag – there is no battery. Instead, the tag uses the energy of the radio wave to power its operation, much like a crystal radio. This results in the lowest tag cost, but at the expense of performance.

D. Glcd:-

This library makes it easy to use a Graphical LCD with Arduino this is an extensive modification of the ks0108 library that has higher performance, more features, supports more Arduino boards and is easier to integrate with different panels.

Sketches written for the old library should work with little or no modification. Theconfiguration mechanism has been changed to facilitate use with a broad range of GLCD chips and AT megaControllers, See the section on sketch migration for details on modifications for the new library.

E. Power supply

Power supply is used to give the 5V to the controller. 5V can be received from IC voltage regulator. Inside the power supply rectifier, filter is present.

F. RFID tag reader

RFID reader is used to read the data's present in the RFID tag. RFID readers or receivers are composed of a radio frequency module, a control unit and an antenna to interrogate electronic tags via radio frequency (RF) communication. Many also include an interface that communicates with an application. Readers can be hand-held or mounted in strategic locations so as to ensure they are able to read the tags as the tags pass through an "interrogation zone."

RFID systems can be classified by the type of tag and reader. A Passive Reader Active Tag (PRAT) system has a passive reader which only receives radio signals from active tags (battery operated, transmit only).

III. HARDWARE AND SOFTWARE REQUIREMENT

A. Software interface

Language use: VB.net, Embedded 'C'
OS Compatible: XP, Vista, W7, W8.

B. Hardware interface

System Configuration: 80GB HDD, 1GB RAM, 3.1 GHz Processor.

IV. PURPOSE OF THE PROJECT

The objective of this project is to improve the speed of purchase by using RFID. This project is designed to use the RFID based security system application in the shopping trolley. This project is used in shopping complex for purchase the products.

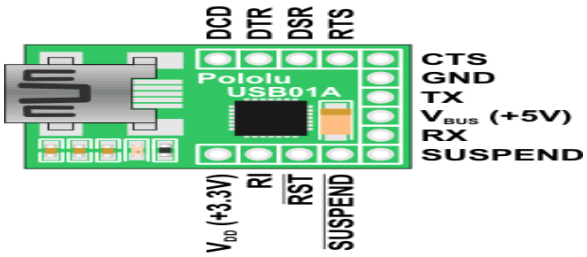
In this project RFID card is used as security access for product. If the product is put in to the trolley means it will shows the amount and also the total amount. But in this project RFID card is used for accessing the products.

So this project improves the security performance and also the speed. The trolley developed will also have the provision to take out the printout the bill of the purchased materials which will be designed using .net graphical user interface with Access database. It will overcome the Barcode technology which gets lots of problems that will recover in this technology such as the barcode method is so slow and some time it will creating error at the reading the barcode if

in case of damaged the barcode it won't be recognized the barcode tag by barcode reader.

A. Serial to USB converter:

It is used to connect the microcontroller output to the PC for Speech conversion.



USB to Serial processor chip, this chip converts all the USB data to serial data and all the serial data to USB data, and a Serial driver chip, this chip provides the power for your the device connected to the serial port of the adapter; it kind of amplifies the signals.

B. contribution:-

Project's foundation is aiming at providing multitasking system to help to improve performance it is most relevant for research, academic as well as institute such as:

C. library management system:

The RFID is the recent technology used in library theft detection system. unlike Electromechanically which have been used in libraries for decades, RFID based system move beyond security to become tracking system that combine security with more efficient tracking of material throughout the library including easier and faster charge and discharge inventorying and material handling.

RFID is a combination of radio frequency technology and micro-chip based technology. The information contained on the micro chip in the tag affixed to library material is read using Radio Frequency technology regardless of item orientation or alignment and the distance from the item is not a critical factor.

The target used in RFID system can replace electromechanical theft detection targets and Barcodes.

D. student attendance system:

This RFID student attendance system provide Robust Secure and Automatic Attendance system this system aims to automate the process of taking attendance on pen & paper and prevent fraudulent entry.

It uses RFID tag to record attendance. Each student is assigned a unique tag which he/she required to swipe over the reader to give his/her attendance. This system benefits both the teacher and student as it quick and hassle free. This set up can be used in any educational institution regardless of whichever board they follow data is stored in a comma separated value (CSV) file which keeps track of each day's attendance. It should be cited as "to be published" . Please give affiliations and addresses for private communications.

Capitalize only the first word in a paper title, except for proper nouns and element symbols. For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation.

E. Abbreviations and Acronyms

[1] RFID :- Radio Frequency Identification
[2] DoD :- Department of Defense
[3] EAS :- Electronic Article Surveillance
[4] EPC :- Electronic Product Code
[5] ISO :- Indian Standard of Organization
[6] ARPT :- Active Reader Passive Tag
[7] LCD :- Liquid Crystal Display
[8] PCB :- Printed Circuit Board
[9] BAP :- Battery Assisted Passive
[10] CRT :- cathode ray tubes
[11] PRAT :- Passive Reader Active Tag
[12] IDE :- Integrated Development Environment
[13] SCC :- Server Communication component
[14] UIDC :- User Interface and display component
[15] ABC :- Automatic billing component

V.CONCLUSION

The intended objectives were successfully achieved in the prototype model developed. The developed product is easy to use, low-cost and does not need any special training. This project report reviews and exploits the existing developments and Different types of radio frequency identification technologies which are used for product identification, billing, etc. We have also learned the architecture of the system that can be used in the shopping systems for intelligent and easy shopping in the malls to save time, energy and money of the consumers. Present trends point towards the fast growth of RFID in the next decade. With around 600 million RFID tags sold in the year 2005 alone, value of market including systems, services and hardware is likely to grow by factor of 10 between years 2006 -2016. It is expected that total number of RFID tags delivered in the year 2016 will be around 450 times as compared to the ones delivered in the year 2006.

This project reviews and exploits the existing developments and Different types of radio frequency identification technologies which are used for product identification, billing, etc. Thus the survey paper studies and evaluates research insight in Radio Frequency Identification systems from a big picture first. We have studied in detail about the business model, technological model and all related work and applications in the domain of RFID

based systems that make ease of identification. We have also learned the architecture of the system that can be used in the shopping systems for intelligent and easy shopping in the malls to save time, energy and money of the consumers. Thus RFID has a wide scope in the supply chain management. In the future, if all studies are favorable, we will advance with the implementation of a prototype for proposed architecture for testing in a real hypermarket scenario because RFID is a technology that has the potential to improve our lives to a very great extent.

The RFID technology will be considered not just simple accomplishment of some research, but an efficient solution for companies, which will determine visibility on developing the business processes in a correct manner and of complete transparency. The intelligent shopping system can significantly change the manner in which shopping is performed, thus easing the life of buyers, always confronting with time. The retail supermarkets of the future will present

significantly less checking queues, with a view to develop the own services and those of the staff, within steps of efficient performing of activities specific to shopping. An RFID implementation that assumes for the time being large expenses will become approachable in the future . In many applications, the great cost of RFID technology will be balanced out by the achievement of the best solution and results of problems.

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Satish Kamble, Dip. CT, B.E. (Perusing) 8th SEM Information Technology, Rajiv Gandhi College of Engineering Research, Nagpur, India, php certified e-mail: satishkamble87@gmail.com

Sachin Meshram , Dip. CT , B.E.(Persuing) 8th sem Information Technology, Rajiv Gandhi College of Engineering Research, Nagpur, India,
IT, NATIONAL SOCIETY FOR TECHNICAL & COMPUTER EDUCATION EXAM-2008 "A" Grade in 'C' Programming, JAVA Certified.

Rahul Thokal, Dip. CT , B.E.(Persuing) 8th sem IT Information Technology, Rajiv Gandhi College of Engineering Research, Nagpur, India,java certified,c-certified

Roshan Gakre, Dip. CT, B.E.(Persuing) 8th sem Information Technology, Rajiv Gandhi College of Engineering Research, Nagpur, India, JAVA Certified