

RFID based POS System

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Abstract - An innovative product with societal acceptance is the one that aids the comfort, convenience and efficiency in everyday life. There are number of supermarkets in each city having a huge amount of people visiting on a daily basis. Now a days purchasing and shopping at big malls is becoming a daily activity in metro cities. It is seen that there is a huge rush at malls on holidays and weekends. The rush is even more when there are special offers and discount. The payment of bill by standing in long queue is a tedious factor. The existing system is the Barcode technology in which the barcode must be in the direct line of sight to be read by barcode scanner. Barcode have no read/write capabilities and can be easily reproduced, which results in less security. If the barcode is ripped, damaged there's no way to scan the product. To overcome this, the proposed system uses radio frequency identification technology that has gained position in various innovative applications that also results in the speed of handling manufactured goods and materials. RFID can detect the tags using RFID reader from distance without the line of sight. It allows contact less detection of the objects using the radio frequency and supports the read/write memory capability and it can hold large amount of data under a unique identifier. Using the RFID technology the time of people in queues will be reduced to 1/3rd of the total time taken to stand in the queues. People can place all their products on the plain area where an RFID reader will be placed which will be scanning all the items having RFID tags simultaneously and automatically updates the details of each item into the computer. Thus, a single person is enough at the billing section just to print out the bill and hand it over to the customer other than having three people at each counter. Thus, reduces the overall waiting time of the customers and enable a better shopping environment for the customers.

Key Words: RFID, POS, UHF, GUI, IDE

1. INTRODUCTION

These days, RFID's are widespread and taking role in many advanced projects due to its fast and effective response. RFID are generally tags that are used for unique identification of products by using radio waves. These RFID's offer more advantages over conventional Barcodes as they have a major drawback which is Line of sight technology and also

these barcode tags have constraints in its durability whereas the RFID's tags are more durable and able to read/write data which could even be encrypted. These tags could hold plenty of data like products name, price, size, weight and other information using their identification number. By implementing this RFID technology for unique representation of each product in a market shopping is done more easily. RFID (Radio Frequency Identification) technology provides ability to many new services and quality in the busy environment. The paper discuss about the RFID implementation system used for bulk billing at malls or markets. This will enable the consumers satisfaction, reducing time requirement for payment and also the manpower required at markets or malls by instantly payoff their entire purchase upon arrival at the payment counter, increasing customer. These RFID tags are utilized to automate the checkout process by building a system that could read the RFID signals of all the objects that would be placed in proximity to an antenna platform. This eliminates the need for barcode scanning of each individual item, making checkout a significantly faster experience. The tags are little in size and so it can be easily pasted on products RFID tags are an improvement over barcodes since you can update or change the information on the tag. Since it communicates with the network, it can take the data stored on it change it to something new. The network connected to the reader can update or change the data stored on the RFID tag if necessary.

1.1 PROBLEM FORMULATION

The use of barcodes in the retail industry all started back in the late 1940's and early 1950's to figure out a way to acquire product information when a customer checked out groceries. Barcodes became commercially successful when they were used to automate supermarket checkout systems, a task for which they have become almost universal. Their use has spread to many other tasks that are generically referred to as automatic identification and data capture (AIDC). In stores, barcodes are pre-printed on most items other than fresh produce from a grocery store. This speeds up processing at check-

outs and helps track items and also reduces instances of shoplifting involving price tag swapping, although shoplifters can now print their own barcodes. Yet barcode system has their own disadvantages. Label damages, less information storage, human effort and line of sight provides the basic issues faced by the barcode system. In order to overcome this issues. Our project proposes a RFID based POS system.

- Barcodes are designed to be scanned one at a time whereas many RFID tags can be scanned at once.
- Barcodes require that the scanner maintain a line-of-sight with each code, while RFID is a “near field” technology, so the scanner only needs to be within range of the tag to read it.
- Barcodes are generally printed on paper or adhesive labels, so they are prone to wear and damage, while an RFID tag is generally a tougher product that can withstand more abuse.
- The type and volume of data on barcodes is more limited than what can be stored on an RFID tag.

On the other hand, the advantages offered by RFID have made it very popular in recent years, especially for people who’ve been working with barcodes for some time and have faced frustration due to its inherent limitations.

1.2 OBJECTIVES

The objective of this project is to create an RFID POS system to improve the speed of purchase in retail business, also to reduce the workload of the staffs and hence increase the productivity. As per a survey conducted by University of Oklahoma in 2015, 80% of customers are frustrated being in long queues. Hence, the GDP growth of retail industry has been reduced to 1.6%. The current barcode system and the outdated technologies in retail business are the main issues of this decreased rate. The proposed system built on top of integrated RFID will be the right replacement for the existing barcode and outdated technologies used by retail shops. RFID POS provides easy and fast scanning of products and fast generation of invoice at the billing counter. This will reduce the queue at the billing counters of retail shops and hence increase the productivity. Hence, customers are freed from the stress of waiting on a long line of queue to get the billing counter, thus avoiding all the RUSH, HUSTLE, WAITING and STRESSING, "The main tensions u want to avoid in shopping".

Key Features are:

1. Faster and easy billing
2. No WAITING for billing : Faster exit
3. Automated instantaneous CURRENT TOTAL on display : better budget calculation #

4. Automated inventory management
5. Better anti-theft security
6. Higher Efficiency
7. Higher throughput : Of billing and customer satisfaction

2. PROPOSED SYSTEM

RFID based pos system aims at increasing the efficiency and productivity of retail shops, mainly for large shopping malls where people face the issue of time consuming process at the checkout area. Unlike the barcode system, this system provides much faster way of checkout at the billing counter. The system includes RFID tags attached to each product in the shop which contains a unique ID that helps to retrieve information about the particular product from the database. The salesperson can login to his account using the provided username and password. Once logged in, salesperson can access the billing page on which he/she can run the purchase orders. The salesperson will place the products on to his table where RFID reader is placed. Once the products are placed to the area on the table, RFID reader starts capturing the data, matchup with the data stored in the database. The application will automatically generate the invoice based on the captured data. The invoices are produced by reading the data from the RFID reader using java listeners in the java program written for desktop application. Salesperson can place the order and mark order as completed.

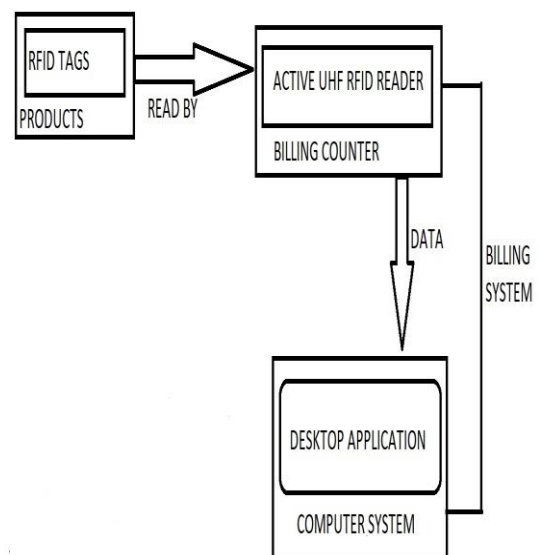


Fig -1 System Architecture

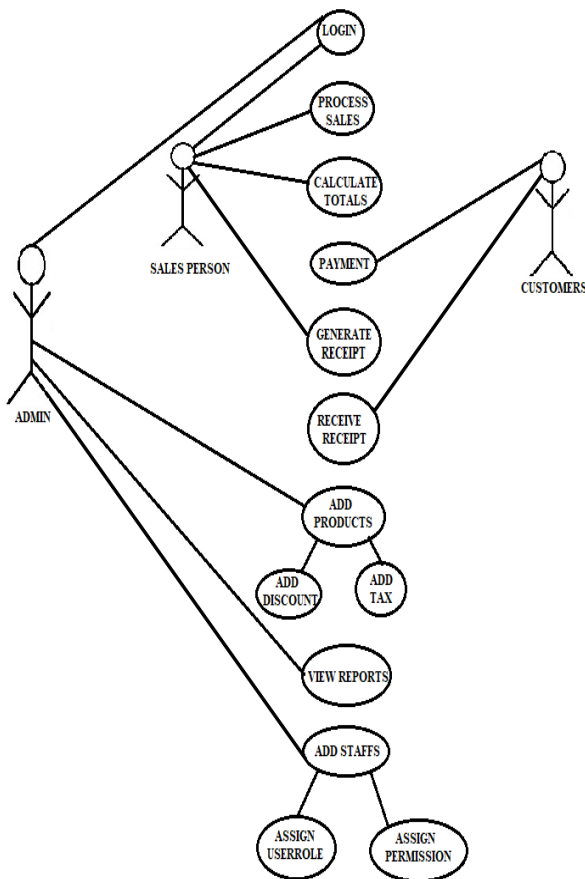


Fig -2 System Usecase

2.1 MODULE DESCRIPTION

The RFID based pos system consists of:

- Customer Management
- Sales Order
- Inventory Management
- Staff Management
- User Role
- Reports

A. CUSTOMER MANAGEMENT

Customer Management encompasses all the systems, processes and applications needed to manage the customer relationship. It describes all aspects of sales, marketing and service-related interactions that a company has with its customers. Customer Data is an extremely valuable asset of any business. This module helps us to manage all the customers. This provides all the details of customers visiting a shop. It stores customer data and purchase history which is useful for advertising in future

as this data can provide insights on which customer would be interested in the sale.

B. SALES ORDER

This module used in the system will capture all the sales order simultaneously and automatically generate the invoice once the products are placed upon the RFID reader. There should be an option to place order manually in case RFID isn't responding. That is the order will be added manually by the staff at the counter if RFID fails to read. The Sales Orders module allows you to store details of orders that have been received from the customers. Then the system will automatically generate customer invoice upon capture of the products.

C. INVENTORY MANAGEMENT

The module help us to add, edit, delete...etc products. Inventory management makes a systematic approach to sourcing, storing and selling finished products. The module helps to get the right stock at the right levels at the right time. The module has 4 sub-modules such as category, product label, payment mode, tax. The category allows to add unlimited product categories such as soaps, biscuits, chocolates..etc. The product label module allows the user to create labels of the product such as dettol soap, bourbon biscuits, munch..etc. The tax management module help us to manage tax of the product such as gst,sgst..etc. The added tax will automatically apply on the product. The payment module manages the payment types such as cash, credit card..etc.

D. STAFF MANAGEMENT

The staff management module on-boards staffs with certain roles assigned. The on-boarding system collects staff information like full name, mobile number, username, password, user-role. The staff can login to the system using the provided username & password. The staff can update his/her profile information on the software.

E. USER ROLE

This help us to setup certain permissions based on staff designations. Based on the assigned permission, the staff dashboard and menus will be automatically setup by the system. A user role aggregates a number of access rights for the staffs in a shop. It includes permissions of each staffs according to their roles in the shop. The module can be set up with fine-grained permissions to the users allowing each role to be done only when the administrator permits.

F. REPORTS

The report module provides insights of the activities such as sales, stock, staff. The sales report has a filter to choose the date range and filter out the orders within the chosen period. The software has an option to export the reports in excel format. The stock report provide real time insight to

the inventory, low inventory remainder provides information about the products which are getting low in the stock. The staff management report provides the reports of all the staffs.

2.2 SYSTEM REQUIREMENTS

A. INTEGRATED RFID READER

The integrated reader (VI-89 UHF RFID Integrated Reader) design for quick deployment in the application environment, to achieve the desired effect; operating frequency, or the European standard American standard 902-928MHZ 865-868MHZ (can be customized adjusted for different countries or regions); support LAN, RS232, RS485 and Wiegand26 / 34, IEEE 802.11, GPIO input and output a variety of ways; 30dbm adjustable output power up, auto mode, interactive response mode, trigger mode and other modes. The proposed system can use the VI-89 UHF RFID Integrated Reader to capture the products. It is highly efficient and is able to capture the products simultaneously without any hassle.



Fig-3 VI-89 UHF RFID Integrated Reader

B. UHF RFID TAG

These paper-thin EPCglobal Gen2 tags work with our Simultaneous RFID reader. The tags can read and be written to --- and also have a kill feature. Each tag comes with a TID (Truly Unique ID) that can't be changed, but there's plenty of memory to write and read from.

Features are:

- EPCglobal Gen2 and ISO/IEC 18000-6c
- 800 Bits of Memory
- 512 User Bits
- 64-Bit Unique TID (unalterable serial number)
- 32-Bit Access and 32-Bit Kill Passwords* Width: 1cm
- Length: 7cm
- Length: 7cm

The RFID tags used in the proposed system is attached to each of the products in the stock. These tags will be responding to the RFID reader provided in the system. On placing the products with RFID tags, the RFID reader will simultaneously read the tags and automatically generate the invoice on the system with all the product details provided in those tags.

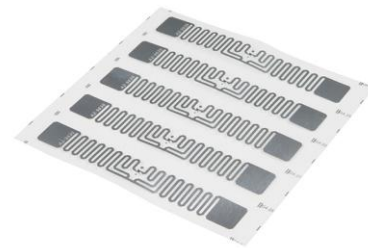


Fig-4 EPCglobal Gen2 tags

C. NETBEANS IDE

NetBeans is an integrated development environment (IDE) for Java. NetBeans allows applications to be developed from a set of modular software components called *modules*. NetBeans runs on Windows, macOS, Linux and Solaris. In addition to Java development, it has extensions for other languages like PHP, C, C++, HTML5, and JavaScript. Applications based on NetBeans, including the NetBeans IDE, can be extended by third party developers. The NetBeans Platform is the framework for simplifying the development of Swing desktop applications. The NetBeans IDE bundle for Java SE contains what is needed to start developing NetBeans plugins and NetBeans Platform based applications; no additional SDK is required. NetBeans IDE 8.2 is used to integrate both the software and hardware parts of the proposed system. It is used to write codes for the software, test and debug the codes and verifies that the system generates the desired results.

D. SCENE BUILDER

JavaFX Scene Builder is a visual layout tool that lets users quickly design JavaFX application user interfaces, without coding. Users can drag and drop UI components to a work area, modify their properties, apply style sheets, and the FXML code for the layout that they are creating is automatically generated in the background. The result is an FXML file that can then be combined with a Java project by binding the UI to the application's logic. SceneBuilder is used to create the GUI layout of the system's application. The idea was to bring user friendly layout for the software, replace with default java layout. SceneBuilder was one of the choices to design the screens for the software since it has modern elements which would add user friendliness of the application.

E. MySQL DATABASE

MySQL is an open-source relational database management system (RDBMS). Its name is a combination of "My", the name of co-founder Michael Widenius's daughter, and "SQL", the abbreviation for Structured Query Language. MySQL is free and open-source software under the terms of the GNU General Public License, and is also available under a variety of proprietary licenses. MySQL was owned and sponsored by the Swedish company MySQL AB, which was bought by Sun Microsystems (now Oracle Corporation). MySQL is a commonly used open source database which is very powerful and been used to build many big applications. In the application, MySQL is used as a database to store the data such as product details, customer details, tax, staff details, inventory details..etc.

2.3 RESULT

The system will have a username and password for the admin/staffs to login. For admin, he/she gets access to all the modules under the POS module. For other staffs, the access to modules depends upon the user roles and permissions assigned to each of them. For a sales person, Once the login has been established, he/she gets access to the POS module. The POS module will have sub-modules like reports, sales order, customer management, staff management and user roles. Then the salesperson will have access to the sales order and customer management modules. In the sales order module, an integrated RFID is been used to capture the products. Once the device is connected with the system, the listener program in the software will listen and capture the products which has UHF RFID tags. The data will be filtered and sent to the database where a check will run against the added product in the inventory. Once the match is established, the system will automatically display the matched product on the POS billing screen. The system will filter out the quantities of same products, Eg: if a user is buying 5 pens, then a single row with pen will be displayed with quantity 5. Then the salesman can generate invoice based on the purchase. In the inventory module, while adding products a unique 16 digit hexadecimal code will be generated for each product depending upon the quantity. With integrated RFID reader the system will write/read the generated hexadecimal code to each RFID tag.

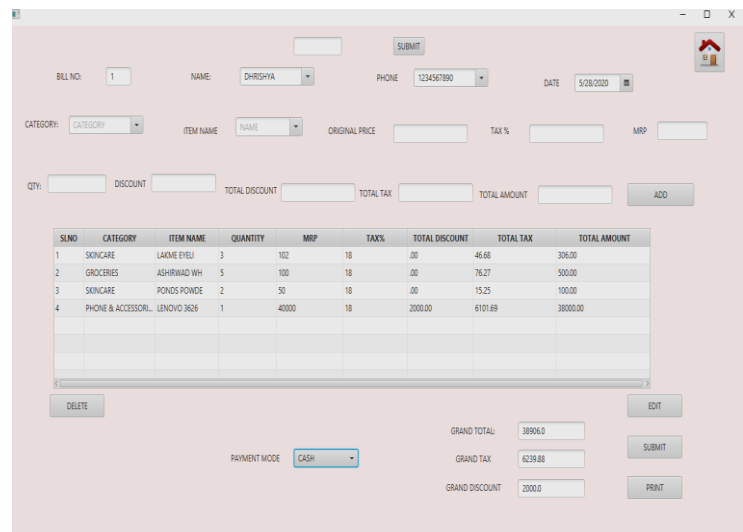


Fig -5 Auto Billing Page

3. CONCLUSION

The proposed system is an efficient system for all retail business. Integrated RFID reader is one of the latest technologies in IOT domain which is been effectively used in retail logistics industry. By using RFID POS system, the growth of retail will be immensely high compared to the current barcode system. The system will reduce the customer queue in retail shops. Thus, increase revenue and customer satisfaction. Compared to current barcode system, the integrated RFID can capture data simultaneously upto 500 tags at a time. On the barcode system, each product has to go one at a time. The system is built using Integrated RFID Reader and software is built on top of Java. The software can be implemented on any Windows machine with USB port. A Web Server can be added as a future scope linked with the software which turn this product to a cloud based POS. All the transactions happening offline will be pushed to the server once it get an internet connection. In the software perspective, there are many future scopes such as advanced reporting system, notifications, invoice on to customer's email, sms notifications, promotions and offers, coupon codes...etc. As an owner of retail business, he/she can access the backend from anywhere at anytime. Android and IOS versions of the software will be welcomed in many different countries such as Africa, USA..etc.

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