IoT based Future Smart Shopping

[1]Blessy Mariya K John [2]Sonamol Joseph [3]Selvakumari P
[1,2]UG Scholar [3]Assistant Professor
[1,2,3]Department of Electronic and Communication Engineering
[1,2,3]Christ The King Engineering College, Coimbatore

Abstract

Now a day's numbers of large as well as small shopping malls has increased throughout the global due to increasing public demand & spending. At the time of festivals, special discounts, holidays, etc. there is a huge rush in shopping malls. The use barcode reading technique in such situations always results in waste time since customer has to wait till whole items get scanned. An inexpensive RFID tag can be attached to each smart shopping cart. The RFID reader can automatically read the specific tag of the cart. The Smart Shopping Cart (SSC) can provide customers with the efficient user interface so that the shopping service can be effectively promoted. By the usage of android application we can easily detect the current location of the products in the market. Android application also having the e-wallet method for the payment. This paper presents a preliminary development of the SSC that can be integrated into the smart mall system.

Keyword- Smart Shopping Cart (SSC), RFID Tag, Barcode Reading Technique, Android Application, E-Wallet Method

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I. INTRODUCTION

Recently, enormous amount of advancements in the field of Internet of Things (IoT) technology has given way to new applications and fields. Now a days the proliferation of supermarkets and shopping malls, added to the rapid development of the IoT technology, has produced various intelligent systems for helping customers in shopping efficiently. The purchasing and shopping at big malls is becoming a daily activity in metro cities. There have huge rush at malls at holidays and weekends. This rush is mainly due to the offers and discounts. Peoples purchase items and put them in the trolley and they need to go for separate billing for the payments. At the billing counter cashier prepare bill using barcode reader for each product. It is a time consuming process which results a long queues at billing counter. All the products in the super market will be equipped with barcode tags. The smart cart is equipped with RFID tag, each smart cart will have specific RFID tags. When the person puts the product in the smart cart it automatically read the details including price will be stored in the memory. As the person put more product in the cart the cost will be added to the total bill. The smart cart contain LCD display, RFID tag, RFID reader, NRF module and Microcontroller. An android application can be used for finding the actual position of the products. E-wallet method can be used for payment system.

II. EXISTING SYSTEM

Currently available method in shopping malls and super markets are barcode scanning system. At the billing counter cashier need to scan each of the product. It will not be easy and accurate as malls can be crowded. It will create wastage of time. At the shopping malls and supermarkets customers face difficulty to find the product, it makes uncomfortable during shopping. Sometimes e-wallet method having some failures in such situation the customers will neglecting this system.

III. PROPOSED SYSTEM

In the past, many inventory management system have been proposed but most of them had their focus on the source and destination rather than on the journey. In this paper we introduce an interactive shopping model along with an automated billing system and navigation. In our proposed system, each smart cart is equipped with a UHF RFID reader, a microcontroller, an LCD, Barcode scanner and Wi-Fi module. Each smart cart having the specific RFID reader which will automatically read the RFID tag of the cart and also the product details. A micro controller is installed on the cart for data processing. And all the data's are stored in this controller. LCD is used as the user interface. All the details of the product will displayed on it. In order for the smart cart to communicate with the server, we have chosen NRF module as high efficient. We are using an android application for the navigation and easy payment. When a customer finishes shopping, they pay at the checkout point using the generated billing information on the smart cart through e- wallet. The owner of corresponding malls and supermarket will get updated details through server.
This project is a pioneer work in the design of secure smart shopping system. We list our contributions as follows.

1) We propose a complete design of the smart shopping system, and we give a description of the designs and corresponding functions in detail.

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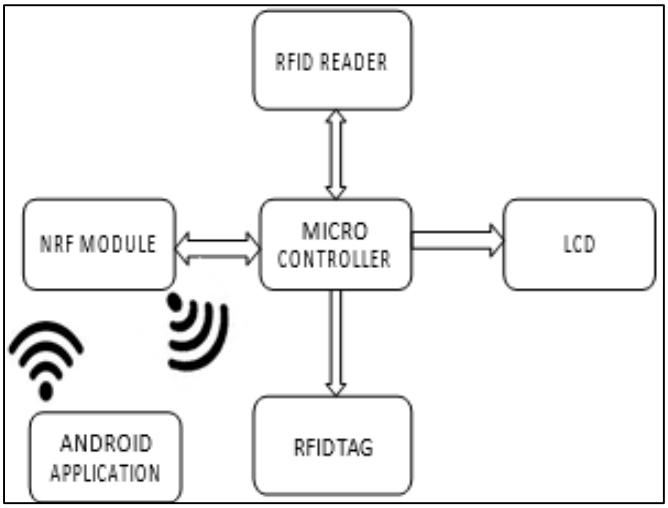
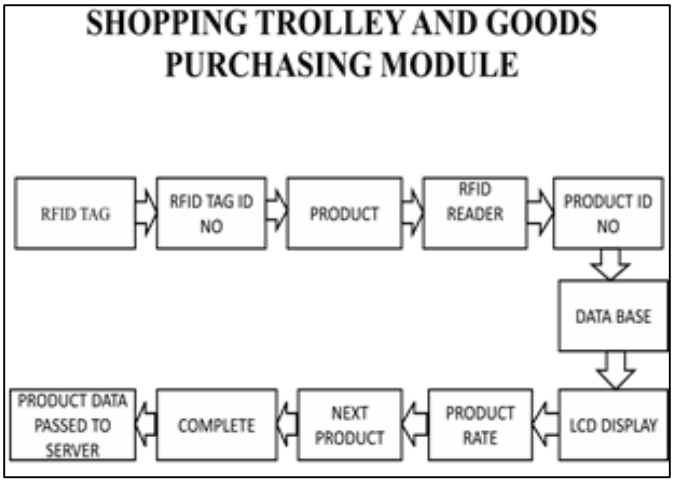
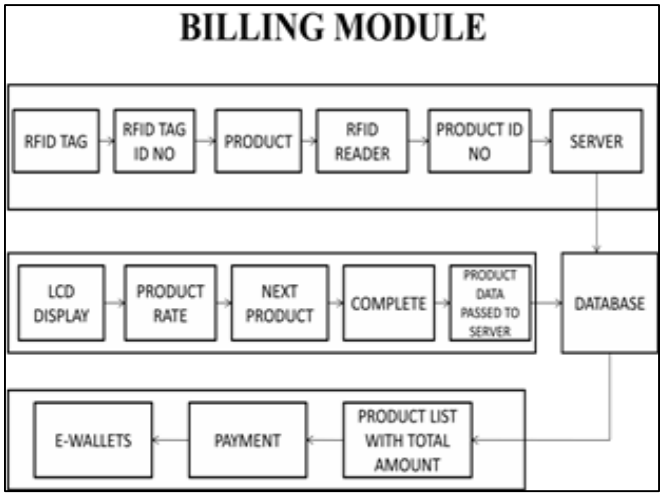
2) We are the first to propose using UHF RFID technology to support connections in a smart shopping system. Our system is the first system to achieve automatic reading of the items with a proper range.
3) We are proposing tracking system for the product identification through android application and e-wallet payment.

IV. BLOCK DIAGRAM





In this module shopping trolley contain particular RFID tag and it can be read by RFID reader. When the customer put the product on the cart all the details are readed by RFID reader and displayed on the LCD. Product data passed to server through NRF module.



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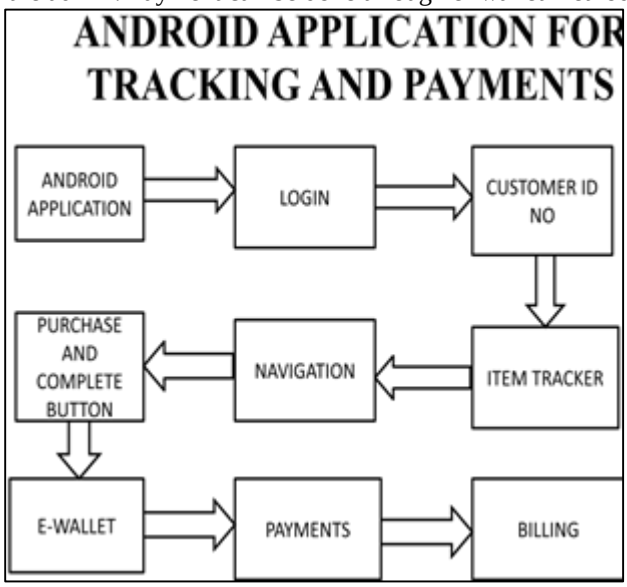
While the server get all the data of products through NRF module it will be stored in the database. The details of product list with total amount will be get by the admin. Payment can be done through e- wallet method.



We are using android application in the purpose of tracking and payments. Android application having a login page for user and admin. For purchasing customer need to register with customer ID number. Then customer need to add list of product then it automatically navigated.

V. COMPONENTS

It with DC adapter or battery to get started. The Uno differs from all preceding Our proposed smart shopping system consists of following components:

1) Server

All items are registered to the server before moved to the shelves. The server stores the all items information's, such as location and price, in a database .The server communicates with all the other entities in the smart shopping system through Wi-Fi.

2) Microcontroller

Coordinates with the RFID reader, Wi-Fi module, LCD display, Barcode scanner to perform computing functions.

3) Smart cart

Smart cart contain following components RFID reader, Barcode scanner, LCD display, Wifi module, Microcontroller.

4) WIFI module

It is a high efficient module used for data transmission from cart to server.

5) RFID reader

We use an ultra-high frequency (UHF) RFID reader which allows a reading range up to 10 meters. By tuning the transmission power of the reader, we can control its reading range.

6) User Interface (LCD display)

Displays product information, possible navigation choices, billing information and coupons etc.

VI. ARDUINO

The Arduino Uno is an open source microcontroller board based on the ATmega328 chip. This Board has 14 digital input/output pins, 6 analog input pins, Onboard 16 MHz ceramic resonator, Port for USB connection, Onboard DC power jack, An ICSP header and a microcontroller reset button. It contains everything needed to support the microcontroller. Using the board is also very easy, simply connect it to a computer with a USB cable or power boards in that it does not use the FTDI USB-to-serial driver chip. Instead,it features the Atmega16U2Atmega8U2 up to version R2) programmed as a USB-to-serial converter. While the Arduino UNO can be powered via the USB connection or with an external power supply, the power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Also leads from a battery can be inserted in the Gnd and Vin pin headers of the Power connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than 5 volts and the board may be unstable.

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VII. RFID MODULE

RFID Reader Module, are also called as interrogators. They convert radio waves returned from the RFID tag into a form that can be passed on to Controllers, which can make use of it. RFID tags and readers have to be tuned to the same frequency in order to communicate. RFID systems use many different frequencies, but the most common and widely used & supported by our Reader is 125 KHz.

An RFID system consists of two separate components: a tag and a reader. Tags are analogous to barcode labels, and come in different shapes and sizes. The tag contains an antenna connected to a small microchip containing up to two kilobytes of data. The reader, or scanner, functions similarly to a barcode scanner; however, while a barcode scanner uses a laser beam to scan the barcode, an RFID scanner uses electromagnetic waves. To transmit these waves, the scanner uses an antenna that transmits a signal, communicating with the tags antenna. The tags antenna receives data from the scanner and transmits its particular chip information to the scanner. The RFID tag consists of a powered or no powered microchip and an antenna. The three different types of tags are described below. Passive tags are the simplest, smallest and cheapest version of an RFID tag as they do not contain a built-in power source and consequently cannot initiate communication with a reader. This allows them to function with much lower signal power levels and act over greater distances.

VIII. LCD DISPLAY

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. LCD has single line display, Two-line display, four line display. Every line has 16 characters. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs.

IX. WI-FI MODULE

WIFI module is ESP8266 is a low cost WI- FI microchip. It is basically a microcontroller. This microcontroller has the ability to perform Wi-Fi related activities. It is widely used as a Wi-Fi module with other microcontrollers and boards such as Arduino.Type-32-bit microcontroller. CPU- 80MHz (default) or160MHz.Memory-64KiB instruction, 96KiBdata.Input-16 GPIO pins.Power-3.3DC.

X. CONCLUSION AND FUTURE RESEARCH

In this project, we propose a secure smart shopping system utilizing RFID technology. This is the first time that UHF RFID is employed in enhancing shopping experiences and security issues are discussed in the context of a smart shopping system. We detail the design of a complete system and build a prototype to test its functions. We also design a secure communication protocol and present security analysis and performance evaluations. We believe that future stores will be covered with RFID technology and our research is a pioneering one in the development of a smart shopping system. Our future research will focus on improving the current system, for example, by reducing the computational overhead at the smart cart side for higher efficiency, and how to improve the communication efficiency while preserving security properties.

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