

Automated Billing System using Smart Shopping Cart

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How to cite this paper: Myint Myat Moe | Su Su Yi Mon "Automated Billing System using Smart Shopping Cart" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 | Issue-4, June 2019, pp.1669-1673, URL: <https://www.ijtsrd.com/papers/ijtsrd25219.pdf>



IJTSRD25219

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The customers have to drop every product which they wish to purchase into the shopping cart and then process is quite tedious and highly time consuming and has created the need for shops to employ more and more human resource in the billing section, and yet waiting time remains considerably high. The customers have to stand in the billing lines for a lot more time than actual shopping time sometimes[1]. Sometimes customers have issues with respect to the incomplete information about the item on sale and waste of unnecessary time at the billing counters. The current shopping environment can be classified it into two categories (1) shopping in-individual (2) shopping in absentia. Shopping in absentia is facilitated in numerous ways including web shopping, online shopping, etc. wherein a shopper does not have to be present in the shopping area. Shopping in-individual involves a person visit to the place of shopping and choosing items in view of different variables including need, convenience, brand and so on[2]. The designed Smart Shopping Cart system intends to help shopping in-individual that will minimize the time spent in shopping. This "Smart Shopping Cart" consists of Arduino, barcode scanner, LCD, ZigBee. When the customer starts shopping, the customer has to scan the barcode of the product with the barcode scanner present at the cart, after which the product has to be put into the trolley. The product's name, price, total price and total quantity will be displayed on LCD display. All this information is wirelessly transmitted by the ZigBee module to the Base Station. Base Station at the payment counter consists of a database that stores information of all the products, and a ZigBee modul to

ABSTRACT

Supermarket is a form where wide variety of product items is available. The main purpose of supermarkets is to provide availability of all the products and save the time of the customers but sometimes customer gets frustrated while waiting in the queue at billing counter and sometimes they get confused while comparing the total price of all the products with the budget in the pocket before billing. To overcome these problems, a Smart Shopping Cart system is designed. The system will be implemented into two parts. First part is the customer side. In this part, smart shopping cart which contains barcode scanner, LCD, microcontroller and ZigBee transmitter. Barcode scanner used to scan the barcode ID on product and LCD display used to display the product details such as product name, price, quantity and total amount etc. Microcontroller used for manipulation and sending data to server and ZigBee module used to send the data to the billing counter. Second part is counter side which contains ZigBee receiver is connected to billing PC using serial communication. It receives billing data and gives it to the PC by using Visual Basic software. Product lists are stored in database by using Microsoft Access database system. Purchased product's quantity is subtracted from the product lists and saved in database.

Keywords: Arduino Uno, Microsoft Access, Visual Basic, ZigBee Module

I. INTRODUCTION

In the modern world, every supermarket employ shopping baskets and shopping trolleys in order to aid customers to select and store the products which they intend to purchase.

communicate with the Smart Cart in the mall. Final billing is done by Visual Basic software on computer. This system will save time of customers and manpower required in mall.

II. System and component description

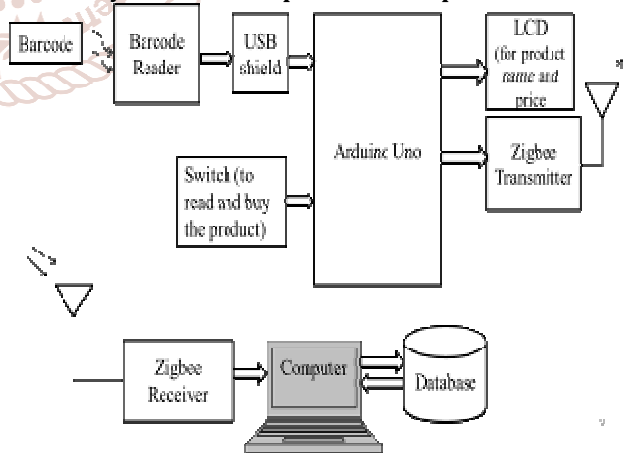


Figure1. Overall Block Diagram

In this system, The shopping smart cart include the setup containing barcode scanner, arduino, LCD display, ZigBee module. The "Query switch" is used when the customer wants to query the product of name and price on the LCD before buying products. "Buy switch" is used when the customer want to purchase the product. The customer have to self-scan the product which they wish to purchase and put it into the cart. With the help of the barcode scanner, barcode

is generated which is send to Arduino. Arduino interfaces with memory unit where all the information about the product and its price. The barcode ID is compared with the information in the memory unit and the result will display on the LCD. The data of products which is displayed on the LCD would send to the computer at billing counter through the ZigBee transmitter. The data which is sent from cart through ZigBee transmitter is received at computer through ZigBee receiver. The product lists are stored in database. After, purchased products subtract from the product list and saved in database.

A. ZigBee Module

ZigBee is an open global standard for wireless technology designed to use low-power digital radio signals for personal area networks. ZigBee operates on the IEEE 802.15.4 specification and is used to create networks that require a low data transfer rate, energy efficiency. The devices are secured by 128 bit symmetric encryption keys. ZigBee operates at 868 MHz, 902-928 MHz and 2.4 GHz frequencies. Data rate varies from 20Kb/s to 250Kb/s. ZigBee is low-cost and low-powered mesh network widely deployed for controlling and monitoring applications where it covers 10-100 meters within the range. ZigBee also provides long battery life, so it can last for several years[3].

Specification of XBee S2C ZigBee module

- Transmission Frequency: 2.4GHz to 2.5GHz
- Number of Channels: 16 Direct Sequence Channels
- Digital I/O: 15
- Indoor/ Urban Range: 200ft
- Outdoor RF line-of-sight Range: up to 4000ft
- Transmit Power: 3.1mW
- RF Data Rate: 250Kbps
- Voltage requirements : 2.1 to 3.6 VDC
- Current requirements : ~33 mA @3.3VDC(transmit), ~28mA @3.3VDC (receive)
- Operating Temperature: -40°C to 85°C

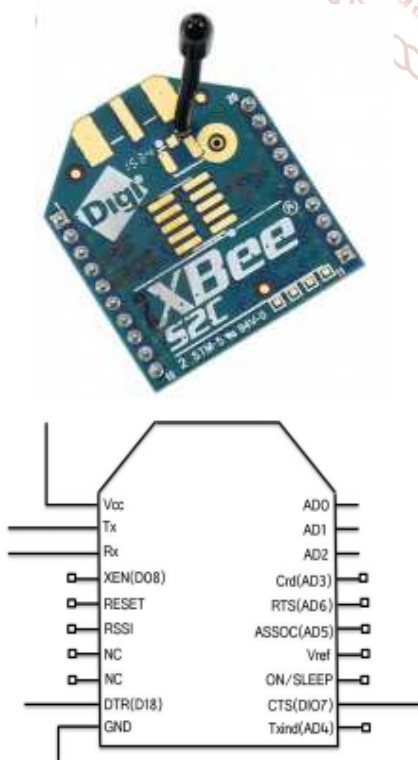


Figure2. XBee S2C ZigBee Module

B. ZigBee Configuration

XBee S2C was firstly connected to XCTU software through COM port serial setting, then there were several parameter settings performed, such as; Baud: 9600, Flow Control: none, Data Bits: 8, Parity: none and Stop Bits: 1. XBee S2C Configuration as Coordinator



Figure3. XBee S2C Configuration as Coordinator

The XBee S2C configuration as coordinator as shown in Figure and the parameters used were Framework XBee: PAN ID: 1234, Destination LOW address: FFFF, AP: TRANSPARENT mode, NI: Coordinator and Baud Rate: 9600.

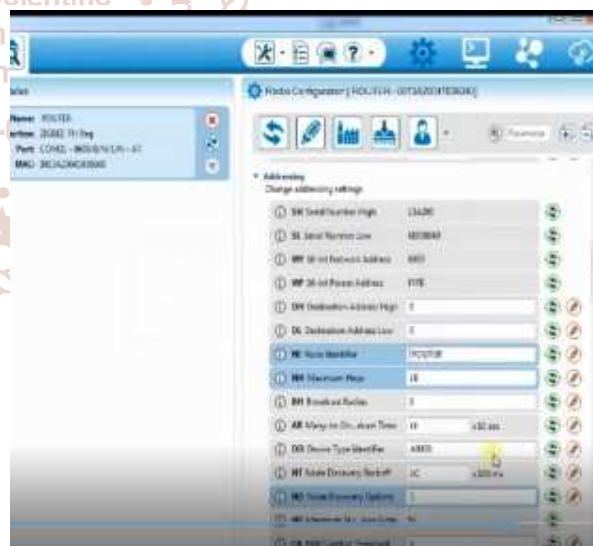


Figure4. XBee S2C Configuration as Router

The XBee S2C configuration as router as shown in Figure and the parameters used were Framework XBee: PAN ID: 1234, Destination LOW address: 0, JV: ENABLED, NI: Router and Baud Rate: 9600.

C. Intrefacing ZigBee with Arduino

The XBee S2C module is the product based on ZigBee protocol. So, it also uses IEEE 802.15.4 standards. ZigBee can be interfaced with external devices very easily. ZigBee can communicate with communication devices, sensors etc. If two ZigBee modules are of same types, then they can communicate with each other. To achieve communication between two ZigBee, first one ZigBee is connected to

Arduino and other ZigBee is connected to computer. There is no need of additional electronics to connect the ZigBee with Arduino. After that, configuration is set on two modules.

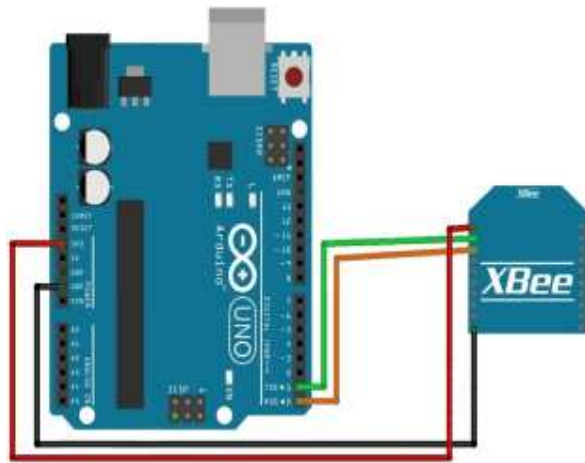


Figure5. Interfacing ZigBee Module with Arduino

Figure shows that the interfacing of ZigBee with Arduino. VCC of ZigBee module is connected to 3.3V of Arduino and GND of ZigBee is connected to the GND of Arduino. The Figure shows that the transmitter and receiver pin of ZigBee is connected to the transmitter and receiver pin of Arduino. Using Arduino board, the ZigBee module can be connected with the microcontroller [4].

D. Microsoft Access Database System

Microsoft access is a database management system from Microsoft that combines the relational Microsoft Jet Database Engine with a graphical user interface and software-development tools. It is a member of the Microsoft office suite of applications, included in the Professional and higher editions or sold separately[5].

E. Microsoft Access Database Creation

Name the database “Product lists in supermarket” and click the Create Button. A new window appear like this, on the Left hand side there is a Navigation Pane, showing table. On Right hand side, this is the main window, showing tabs that are opened. Access creates the database with an empty table named Table 1. Right-Click on the table’s tab in the Main Window, and Select Design view. Name the Table, “Product lists” and Click OK button. For each field in the table, type a name in the Field Name column, and then select a data type from the Data Type list. Create database product’s name, quantity and price.

F. Visual Basic

Visual Basic is a programming language and development environment created by Microsoft. It is an extension of the BASIC programming language that combines BASIC functions and commands with visual controls. Visual Basic provides a graphical user interface GUI that allows the developer to drag and drop objects into the program as well as manually write program code[6].

G. Connecting Microsoft access and Visual Basic

To build a computerized system, programming language, database file and a connection language to join database file and coding are essential choice of the system. This system is created by applying Visual Basic 6 as a programming language and Microsoft Office Access 2010 as a database.

The results depending on user need can be calculated by the programming language. Therefore, Microsoft.JET.OLEDB.4.0 is necessary as a connection tool between programming language and database.

III. SYSTEM IMPLEMENTATION

A. Barcode scanning with barcode scanner

In arduino, ten of product and price lists are created as program. Each number of barcode is checked with the ASCII code and that barcode is defined with the item’s name and price in the program. When barcode reader reads the barcode, barcode ID is compared with the information in the memory unit and the product’s name and price will display on the LCD .The total bill amount is sent to the billing counter via ZigBee.

B. ZigBee Data Transmission

ZigBee operates in the worldwide 2.4GHz band. 2.4GHz band application has 16 channels with spacing of 5MHz and data rate is 250kpbs. In this system, it used two ZigBee modules, one for transmitter and one for receiver. For communication, one of the radio S2C is configured as coordinator and other one as router. XBee S2C was connected to XCTU software through COM Port serial setting, then there were several parameter setting performed, such as; Baud rate :9600, Flow Control :none, Data Bits :8, Parity :none and Stop Bits :1. The data that sent is decode by using asynchronous transmission. It is a wireless point-to-multipoint data communication between smart shopping cart and billing counter.

C. Implementation in Billing Counter

In billing side, Ten of product lists are stored in database by using Microsoft Access database. Sent data is searched in database and is shown the items name. Calculate total amount and billing information is shown by GUI using Visual Basic software.

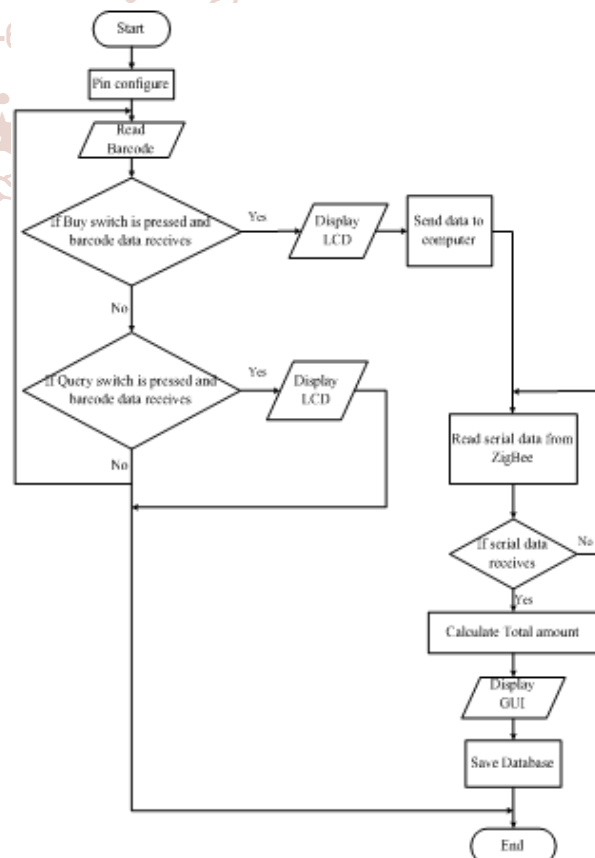


Figure6. The Flow Chart of the System

In Figure 8, the flow chart of the system is shown. It states that after pin configuration of the system, the barcode reader will read the barcode. If barcode data receives by scanning barcode of item and query switch is pressed to know about the product, the information of the product will display on the LCD. If barcode data receives by scanning barcode of item and buy switch is pressed to buy the product, the details of respective item is displayed on LCD screen and the data is sent to the computer. In computer, serial data is read from ZigBee. If serial data receives , calculate total amount and display with GUI. The product lists are saved in database.

IV. TEST AND RESULT



Figure7. Complete Design Smart Shopping Cart

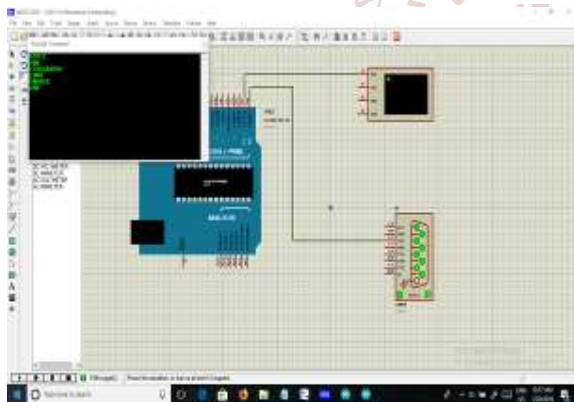


Figure8. Circuit Diagram for Arduino and Barcode Scanner by Using Serial Data Receiving



Figure9. Scanning Product to Query the about of Product Using Query Switch

Figure 11 is shown that Query switch is pressed and the customer self-scan the product to query the name and price of the product before buy the product.



Figure10. Scanning Product to Buy Using Buy Switch

Figure 12 is shown that Buy switch is pressed and the customer self-scan to buy the product. LCD shows the name, price, total amount and total quantity of the product.



Figure11. Result from Customer Side

Figure 13 shows that the total bill of purchased product at the trolley side. The customer bought first item, nabiti its price 250, overall total is 250 and quantity is 1. The customer bought second item, fresko its price 200, total overall is 450 and quantity 2.

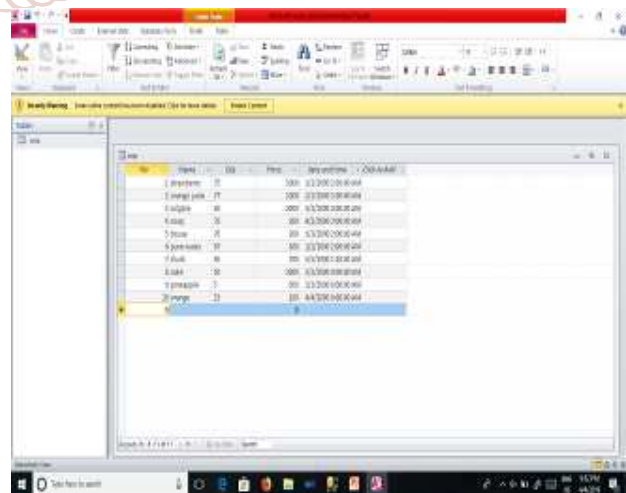


Figure12. Product Lists in Billing Counter

Figure 14 shows that the product lists are stored in database at the billing counter by using Microsoft access database system. Product lists consist of product name, price and quantity.

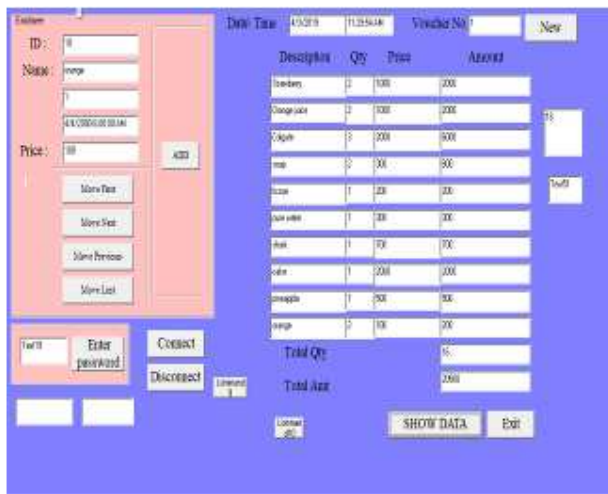


Figure13, Total Bill at Counter Side

Figure 15 shows that the view on the billing counter which contains the product name, quantity, cost of each product, total quantity and total amount of bill. The product's information of the items of the customer bought will be arrived sequentially at the billing counter and show with Visual Basic software. Shop manager can press password to change the product price.



Figure14. Decreased Product Quantity in Database is shown with GUI

Figure 16 shows that the product quantity of the customer bought is subtracted from the product lists in database and show with GUI. The decreased product quantity is saved in database.

V. CONCLUSION

In this system, customer side and counter side is implemented. Each number of barcode is checked with the ASCII code and product name and price has been shown on

the LCD display. Ten of product lists are all well done without error. The data from the smart shopping cart has been sent to the billing counter by using wireless ZigBee module. The configuration of ZigBee module has been done through X-CTU software. Ten of product lists has been created in database in billing counter. The billing information has been shown with GUI. In this system, because of Query Switch and Buy Switch is setted up, the user can query the about of product before buy the product and the user can pay the bill confidentially in billing counter after buy the product.

When the product was bought, the customer no longer have to wait near counters for payment of bills because of their purchased item information getting transferred to central billing system. This smart shopping cart will be very beneficial as it would reduce the number of salemen and billing counter and also prove to be time saver for both customer and the shopkeeper.

ACKNOWLEDGEMENT

First and foremost, the author would like to thank her academic supervisor, Dr. Su Su Yi Mon, Professor at the Department of Electornic Engineering in Mandalay Technological University, and gratefully thanks her for kindness and providing with motivation, thoughtful suggestions, perceptive comments and observant guidelines. The author also would like to express her appreciation to Dr. Sint Soe, Reactor and Principle at Mandalay Technological University and Dr. Tin Tin Hla, Professor and Head of the Department of Electronic Engineering at Mandalay Technological University, and then all teachers for their kindness with sharing technical knowledge and supporting. The author specially thanks to her family and her friends for their supports and encouragement.

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