

IOT based Smart Shopping Trolley for Super Market

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Abstract—Nowadays, supermarkets are almost developed with much technological advancement. People purchase different items from the supermarkets and put them into a trolley because it's the simplest method employed in supermarkets to hold goods. However, throughout the entire process of shopping, customer must push the trolley manually by their own effort and when it involves the billing process customers must wait in long queues to pay their bills. This can be a time-wasting process because of the busy schedule of individuals. So, to avoid this our project presents development of the smart shopping trolley (SST) that may be integrated into the smart mall system. The SST can provide customers with the efficient interface so the shopping service are often effectively done. With the utilization of radiofrequency identification (RFID) tags, the SST can automatically detect the assorted products which are being added within the cart and show the related information on the computer program (LCD and webserver). Finally, the automated billing service is done by the SST and therefore the stored shopping data are going to be transmitted to the net or cloud server of mall through ESP8266. So, the proposed SST interacts with the customer and provides efficient shopping service.

Index Terms— Smart Shopping trolley, RFID, ESP8266, NodeMCU, Supermarkets, Billing, RFID Tags.

I. INTRODUCTION

Nowadays people interest in shopping is increasing day by day and that's why rush is also increasing in malls. We all like to do shopping, its easy, but waiting at the bill counter can be very boring and time consuming. P Kalaivani et al. [1] concluded that rush plus cashiers who prepare a bill with a barcode scanner take longer and have longer-lasting results. The Smart Cart is having all the traditional services and also includes scanning an item to check for price and details, also there are other additional features are also available that will be included in the design such as finding an item in the store by typing the item name in the search field on the user interface screen which will automatically show the items location in the store. Sainath, S et al [2] proposed that the Smart Cart is designed for an efficient billing system and also to reduce time wasted in long queues. Ankush Yewatkara et al. [3] explained that the main purpose behind the smart trolley is to reduce the long queue in front of cash counter. Vidya Palve et al. [4] this system is having the feature of self-checkout by customers can save their time. Other than it will also lessen the time of shopping and reduce the labour cost. Himani Pangasa et al. [5] proposed innovative system includes an automated billing system based on RFID that can be placed in a shopping trolley. This automated payment system includes an RFID cards and RFID readers with NodeMCU to

build the Smart shopping Cart instead of the traditional barcode readers. We see these days RFIDs are getting used in many applications and taking role in many advanced projects due to its fast and effective response. RFID tags are unique identification tags that are placed inside products which stores all the information of that product. The shoppers can deposit cash in counters after shopping, balance & other details like cart information and total value will be updated on the webpage as well as on LCD. Each RFID card is installed with a certain product and an RFID reader is installed in the cart, which reads the product details like price and sends them to NodeMCU and ESP8266.

II. LITERATURE SURVEY

A. Smart shopping cart with customer-oriented service

Chiang, Hsin-Han, et al. [6] presents concept of smart shopping cart fitted with facial recognition and information retrieval features. An automated billing system is added to reduce the queues during checkouts at bill counter. During shopping hours face recognition of customers is a difficult process and it may fail or can show inaccurate results as malls can be crowded. This may lead to many errors during authentication.

B. Smart shopping trolley using RFID

Thiyagarajan, Manikandan, et al. [7] connected RFID readers on the trolley to centralized server using ZigBee communication. The bill generated by scanning of products goes directly to central server for billing. Customer has to pay the bill at the billing counter after it is transmitted to the billing section, which is a major difficult task for customer.

C. Advanced Shopping Trolley using RFID

Ambekar, Komal, et al. [8] used an RFID reader installed to scan each product and load it which is controlled by a microcontroller. Also, a unique RFID based customer card is provided to each new customer and sliding door is provided in cart which runs by DC motor for concern of security. In this they can use enhanced RFID readers that operate in high frequency which can read multiple tags simultaneously. Mobile application can also be developed to avoid smart card and GSM.

D. RFID Enabled Smart Billing System

Sheba, M. Vanitha et al. [9] proposed a model consists of RFID and ZigBee. So, in this system the bill generated after shopping is transmitted at the billing counter and then get collected by the worker present there. This process will lead to queue for billing as only bill generation process is automated by scanning using RFID.

E. Survey on smart shopping cart

A. kumar et al. [10] explained that the the module of this project proposed by the authors is the same scanning the product and displaying the total amount of the bill on the screen. Arduino and Zigbee module are used in this which makes billing system fully automated. Paying bill at the bill counter creates a major difficulty for the customer.

F. Automated Billing using RFID and IoT

Pritha, N., et al [11] has taken a survey and in this survey, as scanner scan the data about the product is being displayed on LCD screen. The bill generated will be displayed on PC via GSM module. Smart shelving is added to the cart which can monitor stock present. Internet service is mandatory in this type of service. Internet instability may lead to failure of billing process and also server error problems may occur due to high load.

III. SYSTEM DESIGN

A. Block diagram of RFID System

- The block diagram consists of 8 components in total where 6 of them will be embedded-attached to the shopping cart.
- The block diagram is having following components: RFID Tags, Reader, Power supply, Switch button, NodeMCU, LCD, Web server and PC.
- RFID tags are Radio Frequency Identification Tags consists of a 12-digit unique code which holds the data or information to be transmitted.
- Each tag consists of a chip and an antenna which is used for identification of objects. Basically, there are two types of tags: Passive and Active.

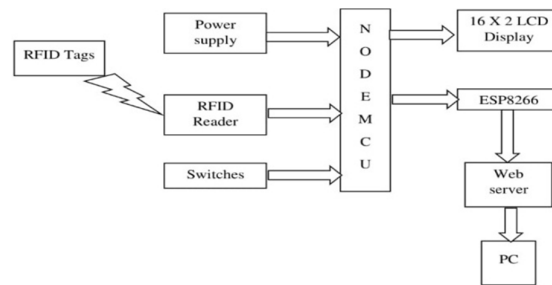


Figure 1. Proposed block diagram of RFID system

- For our project we are using Passive RFID tags as they are small in size, inexpensive and best suitable for short range communication.
- A user has to scan a tag in front of reader so the information will get transferred from tag to reader.
- The RFID reader transmits radio waves and give power to RFID tags so the information will get read by the reader. Electromagnetic waves or Radio waves play a very important role in receiving data from a tag to reader.
- A 5V power supply is given to the RFID system through adapter of 1 Amp. Power adapter or charger is a device which converts AC to single DC voltage.
- NodeMCU is an open-source Wi-Fi protocol based on ESP8266 and can connect devices which can transmit data over Wi-Fi.
- In our project NodeMCU is the brain of the RFID system that controls and coordinates all the activities like sending and receiving of data. The data read by the RFID reader act as input to NodeMCU and it processes the data and send the output to LCD as well as on web page server.
- The data given by the NodeMCU act as input to LCD. A liquid Crystal Display or LCD is a flat-panel display which uses the light-modulating properties of liquid crystals.
- In our project LCD will be used to display the Customer Name and ID, scanned product name and price, also it will display the total items in cart and total price of products.
- The switch button will be used to remove any scanned product from the cart, just by pressing and holding button and scanning that product again it will get removed from cart.
- The final total bill will get transfer to the PC or webpage server over Wi-Fi using NodeMCU and customer can collect and pay the bill at the billing counter.

B. System Flow Diagram

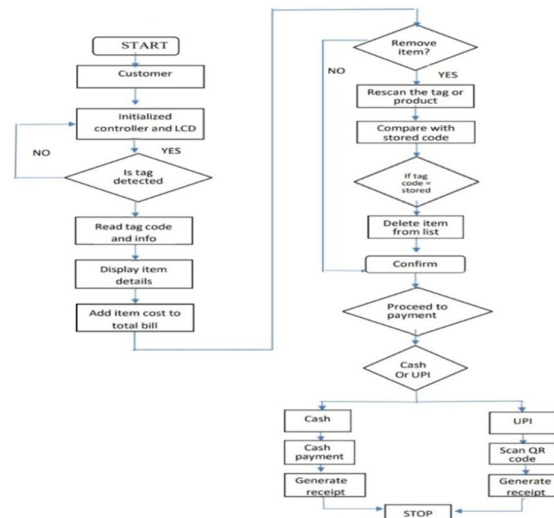


Figure 2. Flow diagram of system

IV. METHODOLOGY

In the Proposed system each product is attached with the RFID Tag and when an RFID reader reads the RFID Tag the information is transmitted to the NodeMCU which processes the information and it connect local server data base through ESP8266. The RFID tag number is compared with the existing data base if the information is available the product data is retrieved from the data base and transmits the details of the product on the LCD screen as well as we can monitor on PC. The customer ID card is provided to each user and when he/she scan that card the customer's name and customer ID will get printed on LCD as well on web page. Also, after scanning customer card user can see total price and total products added in cart on LCD. After that user can start shopping and can add and remove added items from cart. If the user wants to remove any product, he/she just wants to rescan that product by pressing remove button. After the customer finishes the shopping the total number of product user had placed in the cart and amount of final shopping list will be displayed in the LCD screen after scanning customer card. The total list of the products and total amount will be transmitted to the main PC with help of ESP8266 Wi-Fi Module. At the last user just have to pay the total amount at the billing counter.

A. Payment Method and Receipt Generation

When the customer is done with shopping, he/she just have to pay the amount generated at the payment section. Here in our project different kinds of payment systems are available. The present payment system on the tills and self-service checkout as well as cash payment. The self-checkout can be enabled by UPI payments also user can give cash at the billing counter. If the user wants to pay using UPI, he/she can scan the QR code also can-do card payment using credit or debit cards. For cash payments, the bill/receipt is already generated and is sent to the store's database through ESP8266 webserver, and then according to the cart ID and customer ID number the amount generated will get collected by the worker present at the billing counter.

B. Hardware Requirements

- EM18 RFID Reader Module: Radio-frequency identification reader is a device which is use to decode or read the information inside the RFID tag.
- RFID Tags 125 kHz: Radio-frequency identification (RFID) it refers to a technology where digital data is get encoded in RFID tags and get read by a reader via radio waves.
- NodeMCU ESP8266: NodeMCU is a low cost, Lua based firmware, open-source hardware and software developed for the ESP8266 Wi-Fi chip. It mainly used in IOT applications.
- Liquid Crystal Display (LCD) 16x2: liquid Crystal Display or LCD is a flat-panel display which uses the light modulating properties of liquid crystals and can be used as electronically modulated optical device.
- Power Adapter: Power adapter or charger is a device which converts AC to single DC voltage. Basically it provides a steady DC supply from an AC power source.
- LED: A Light Emitting Diode (LED) is a semiconductor device which emits light on supply voltage of around 5 volts.
- Push button: A push button is a type of switch which is used to turn something on or off and consists of a simple electric mechanism.

C. Software Requirements

Arduino IDE:

- The Arduino integrated development environment (IDE) is an open-source application which is written in Java programming language and used to write and upload the code in Arduino board.
- It supports different operating systems such as Windows, Mac OS X and Linux. The source code for the IDE is released under the GNU General Public License, version 1.8.13.C and C++ this are the languages supported by Arduino IDE.
- The Arduino IDE consist of a text editor use for writing a code, a message area, a tool bar having some functions and a text console with series of menus.
- The IDE consists of additional commands within the five menus i.e. File, Edit, Sketch, Tools, Help. The programs or codes written using IDE are called sketches.
- We can see the output of code in console display by compiling code using toolbar buttons.

- That's why Arduino IDE is a very useful software for uploading codes easily in Arduino boards and we can also use the hexadecimal code generated after compiling for simulation of circuits in different software's.

V. RESULTS

We have successfully implemented the circuit of RFID system of Smart Shopping Trolley. Below here are the results of the RFID system.



Figure 3. Smart Cart Phase 1-Welcome message



Figure 4. Smart Cart Phase 2-Customer name Customer ID

First the welcome message will get printed on LCD as “WELCOME TO SMART CART” after activating the trolley. The scanner will also get activated. After that we have to scan the items above RFID reader then the item information will get printed on LCD as well as we can see it on web server. We can see the total price and total added items in cart by scanning the customer card.

Once the system gets activated the user has to scan the customer ID card. Then the customer's name and customer ID will get display on LCD as well as on web server. Now customer can start shopping. The customer ID card is used to show total number of items bought and added in the cart. So, user can keep track on his/ her budget.



Figure 5. Smart Cart Phase 3- Add items to cart



Figure 6. Smart Cart Phase 4- Tea item get added in cart

After scanning the Customer Card, the message will get printed as “PLZ ADD ITEMS TO CART”. Then the user has to scan items in front on reader and the items will get added to cart and also it will get reflected in the final bill. So, the user can add as many items as he/ she wants to add and also can remove items.

User can scan any item which having RFID card in front of reader. Here the item tea is get added to the cart after scanning it in front of reader. The item details i.e., item name, weight and price will get printed on LCD. Similarly, user can scan different items or same item again, so it will get added to the cart as well in the bill. In

between user can check the total items added and total amount by scanning Customer ID card. So, user can keep track on his/ her budget.

Smart Shopping Cart		
Name of Customer:		
Abhijeet Kadoo		
Customer ID:		
2700228A43CC		
ITEMS	QUANTITY	COST
Soap	1	38
Rice(1KG)	1	55
Tea(50g)	1	45
Grand Total	3	138.00

Figure 7. Smart Cart Phase 5 - Total bill generated on Webpage server

Once the customer finishes shopping, he/she just have to pay the total bill generated at the billing counter and bill receipt will get printed. The bill is sent to PC or at billing counter through Wi-Fi which is inbuilt inside ESP8266.

VI. CONCLUSION

In this Smart Trolley System, now there is no need for the customers to wait in the queue and wait for his/her turn for the scanning of the product items. As we know during weekends or festivals there are long queues at the billing counter which is time consuming. So, we made a system to reduce this time spent at billing counter by introducing automatic billing of products. Also using Customer ID user can keep track on their budget. This system reduces time by using RFID Technology and improves utilization of resources like manpower. This shows the easiness of using a smart trolley over the traditional way of shopping. to make the users shopping experience in mall enjoyable this system should be implemented in shopping malls. So, supermarkets or hypermarkets can use this concept as their business strategy to attract more number of customers.

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