

A Smart Trolley for Smart Shopping

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Abstract— Shopping is really fascinating and alluring; at the same time, it involves getting tired due to standing in a long queue for the bill and payment process. Hence, it is proposed to design a smart trolley which can take care of shopping and billing. By this, the customer can walk straightaway into the shop, purchase products using the smart trolley and walk out of the shop. He gets the e-bill through the mail, and he can view his purchase details using the shop's website. In order to realize this, we need an Arduino board, Radio-Frequency Identification (RFID) reader, RFID tag, LCD display, ESP8266 Wi-Fi module, database manager and a website to maintain product and customer details, which can be accessed by the admin anywhere in the world. This is an IOT based system where the trolley can interact with the network spread worldwide.

Keywords— Shopping Trolley, RFID Reader, RFID Tag, IOT, Smart Cart, e-Billing

I. INTRODUCTION

Shopping involves visiting a store, examine the products, take the products, go through the billing section, stand in the long queue, scan the products, calculate the total amount, pay the bill either by cash or credit or debit card. However, sometimes people do not find it enjoying. According to the analysis, people struggle a lot during shopping and it makes them irritable. People want to make shopping much easier and fun. In this way, it would attract more customers to the shop [2]. There is a technology called RFID (radio frequency identification) which helps to make our shopping much easier [6]. Even though bar code system is widely prevailed, RFID has few advantage over the bar code system. This is being represented in Table 1. In order to make this RFID to be operational, Arduino UNO board, helps to interact with the RFID reader and send data to the online database through ESP8266 wi-fi module [4]. Actually, shopping is something that people love to do. They always wanted to buy new stuffs to satisfy their needs and also others [8]. However, some people hate it mainly because of the crowd, long queues in the shop, billing etc [5]. In addition to this, they will be having a tough problem in searching for the products. Sometimes, they happen to lose the bill, since it is a physical entity. There must be a fine solution for this. In concern with the struggle of people during shopping and for the shop owner to adopt the emerging technology to attract more customers, this project has been developed. The advantages of the proposed system are listed below

- The system has the provision of sending the billing details to the customer by mail, which lessen the worries about losing the bill.

- The task of waiting in queues for scanning and billing the products is alleviated.
- The customer can check their buying details online.
- The shop owner can reduce the number of employees in the shop.
- The shop owner can attract quite a many number of customers to the shop.
- The system can make managing the shop easier.

This is mainly to ease the shopping, to invite more customers, to make shopping a fun and mainly to save time. Moreover, customers manage their shopping details online and remain connected with the shop owners for any queries or suggestions and also make the billing perfectly online. The main aim of this project is to ease the shopping for customers and to reduce the number of workers in the shop to save money to the shop keeper. The requirement is to stick the RFID labels to all the products in the store instead of barcode sticker. A comparison of RFID with Barcode is shown in Table 1. Thus RFID reader is being employed to scan the products for billing, to send the data online to store it in the transaction database for future reference for the shop-owner and for providing customers the e-bill. Essence of this approach involves using the RFID system to keep the details of each product. Each label in the products are stored with its name, id, and price. So when it comes in contact with the RFID reader, the reader reads out all those information and add it to the cart. Once the products are selected, the customer can proceed to the billing part. Each customer is given with their smart cards, which contain their id and their balance amount in the card.

II. BACKGROUND

An RFID system generally comprises of three units; they are- an antenna, a receiver and a transponder-RF tag [3]

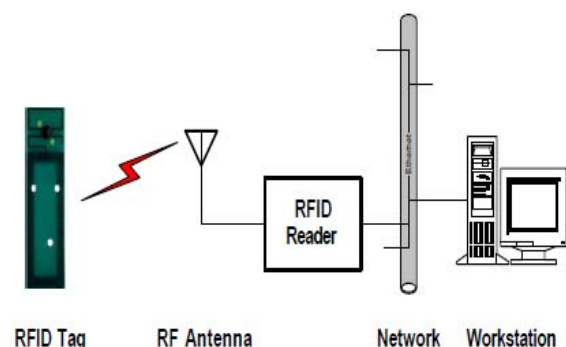


Figure 1. Working of an RFID Tag Antenna

The working of the RFID tag antenna is exhibited in Figure 1 [7]. The tag is activated by receiving the radio signals emitted by the antenna. The tag communicates with the transceiver through the antenna whereas antenna comprises of a transceiver and decoder. Radio waves of different wavelengths emitted by RFID reader. When RFID tag comes across electromagnetic wave, it detects the signal and further decode the data [9].

TABLE 1. RFID Vs BARCODE [1]

	RFID	Bar Code
Rate of reading	More than one tag simultaneously	Single tag at a time
Read/write ability	Can read, write and modify	Only read
Line of sight	Not needed	Essential
Durability	High	Low- cannot be read if soiled
Security	High- hard to reproduce	Low- easier to counterfeit

RFID is widely used in various applications for real time data capturing, some of them are listed below [11]

- Logistics & supply chain visibility
- Attendance tracking
- Library Systems
- RTLS (Real Time Location System)

III. SYSTEM OVERVIEW

The desired system must be reliable while scanning the products and should be consistent in providing right responses to the operations and should properly send all details to the online database. We propose a smart trolley system that involves customer to scan the products and complete the billing process in the trolley itself. The customer has to take the trolley, then scan his card and continue to scan the products. If he wants to remove any product from the cart he has to re-scan it. Once all the products are scanned he can proceed to checkout. Then he has to scan his customer card to deduct the amount from his card. There is also a feature to check the balance in the card. The customer can also view billing details in the online website of the shop.

The admin or the shop owner can also use the system with the help of his master card provided to him. The authority empowers recharging customer card with the master card. Only the master can recharge the customer card, write the product details in the RFID stickers of the product, add customer to the system, issue customer card and maintain online database.

The proposed system is an attempt to automate the billing process in a shopping mall and would be advantageous for costumers as well as for shoppers in

multiple ways. The detailed flowchart of the billing process of the system is depicted in Figure 2.

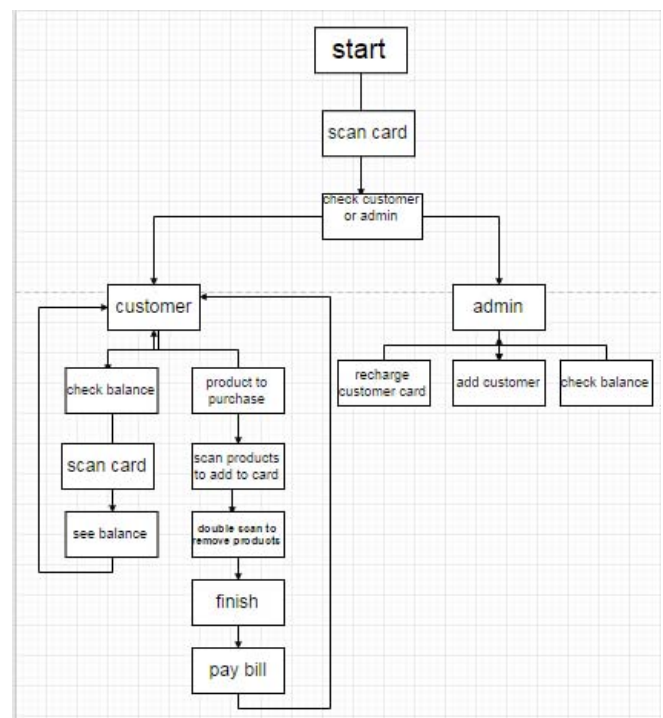


Figure 2. Flowchat of the Billing Process

A. System Architecture

The detailed architecture of the proposed system is represented in Figure 3.

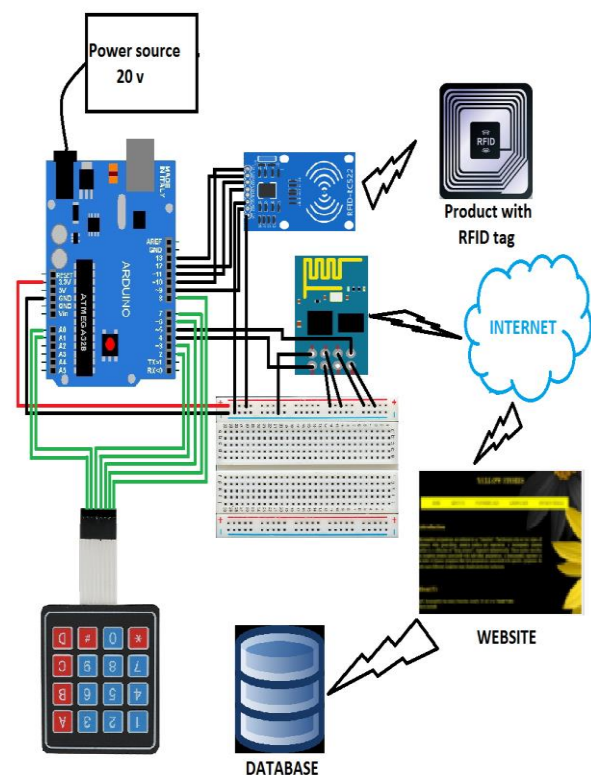


Figure 3. High Level Architecture

B. Detailed Modules

The development of system is carried out in following seven modules. They are as follows:

- Website creation - For the admin to keep track of the products in the shop.
- Database management - To store product and customer details.
- Setting up Arduino with RFID reader, Wi-Fi module and keypad.
- Recharging customer card - To facilitate easy payment.
- Customer card entry - To give customer identity before purchasing products.
- Reading products using RFID - Scanning the products.
- Billing - To calculate total amount.
- Sending e-bill to customer's mail id.

C. Modules Description

Website Creation:

This project used www.godaddy.com for website hosting and database management. This gives the customer an online service to keep track of their purchase details. This project uses the website address www.trolleyonlinesmart.info. It has the provision of customer login page as well as the admin login page by which they enter into the system and they are being provided their own functionalities.

Database Management:

The information about the customers as well as the master details are stored in the database. It receives information from the Arduino and saves it to the database. Additionally, the master can add customer details to the database as well.

Arduino, RFID reader and Wi-Fi integration:

The connections can be made as shown in the architecture diagram. Arduino IDE can be used to do the programming and dump it to the Arduino board. For the Wi-Fi module, the latest AT firmware has to be updated and library has to be installed. For RC522 RFID module the RC522 library has to be installed in Arduino IDE

Recharging Customer Card:

The authority can recharge customer card only with the master card. He has to first scan his card, enter recharge amount and scan customer card to recharge.

Customer Card Entry

Master has the authority to add a customer card. He can provide a customer the unique identity as Uid of card.

Scanning the products using RFID:

The customer has to scan once to add products to the cart and then if he wants to remove he has to double scan the products. Once the product is scanned, ESP8266 send the product details online to add it to cart. Once double scanned, again it sends data to remove it from the cart.

Billing and sending the bill:

The bill amount is calculated in the Arduino module itself, it asks customer to scan card to deduct balance. Once the amount is deducted the data is sent to database. Once all processes are over the web server sends e-bill to the customer by e-mail.

IV. RESULTS

The designed system has the provision of logging into by the customer and admin by customer login page and admin login page. Once sign in is performed successfully, the customer can easily keep track of the purchase details online. Also this makes the seller work easy by using the online database. The result show how robust the system is even during any problem. This is a novel solution that benefits both customer as well as shop owner.

Figure 4 shows a snapshot of functionalities available to the Master by scanning his master card; they include checking balance a particular customer and recharging the customer card whereas Figure 5 represents customer card functionalities available to the customer; they are viewing balance and the act of purchasing.

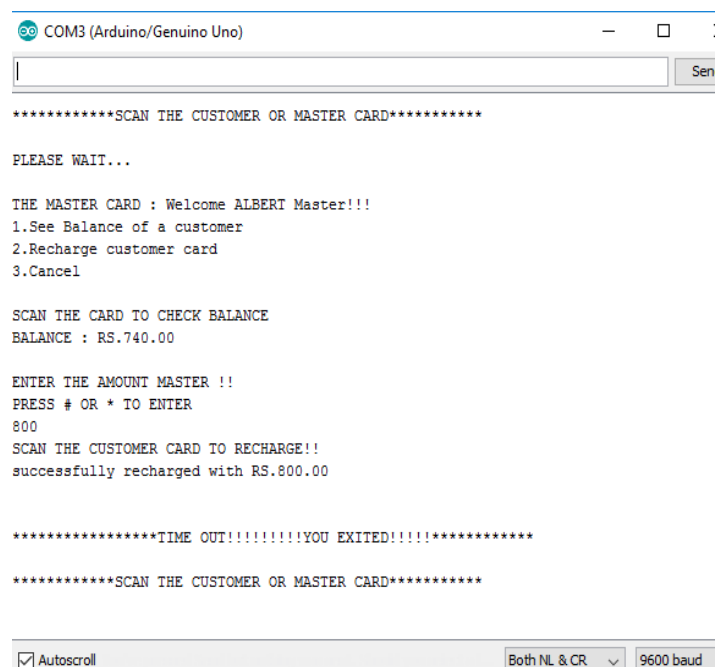


Figure 4. Master Functionalities

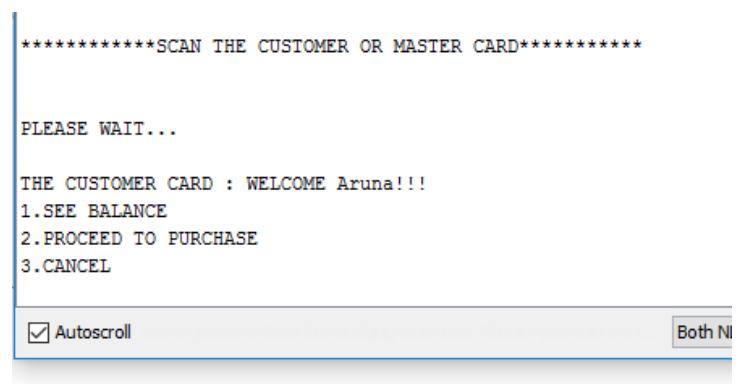


Figure 5. Customer Functionalities

Figure 6 depicts a snapshot of adding products to the cart; the products are added to cart by scanning once. Further purchasing the product results deduction of amount from the balance. Figure 7 shows a snapshot of removing product from the cart by double scanning the product.

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ORDER ID : 1193
START SCANNING THE PRODUCTS!!!
DOUBLE SCAN THE PRODUCTS TO REMOVE IT FROM THE LIST
PRESS # OR * TO COMPLETE PURCHASE
START SCAN

PLEASE WAIT...
*****CURRENT LIST*****
s10  dove shampoo  95.00

CURRENT TOTAL : RS. 95

PLEASE WAIT...
*****CURRENT LIST*****
s10  dove shampoo  95.00
t21  Colgate Paste  70.00

CURRENT TOTAL : RS. 165

PURCHASED ITEMS
1 s10  dove shampoo  95.00
2 t21  Colgate Paste  70.00

TOTAL AMOUNT : RS.165.00
1.DEDUCT BALANCE 2.CANCEL

*****SCAN THE CARD TO DEDUCT BALANCE*****

!!!!!!!!!!!!!!!!!!!!!! AMOUNT DEDUCTED !!!!!!!!!!!!!!!!!!!!!!!

CURRENT BALANCE : RS.1280.00
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Figure 6. Customer purchasing products

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ORDER ID : 1196
START SCANNING THE PRODUCTS!!!
DOUBLE SCAN THE PRODUCTS TO REMOVE IT FROM THE LIST
PRESS # OR * TO COMPLETE PURCHASE
START SCAN

PLEASE WAIT...
*****CURRENT LIST*****
t21  Colgate Paste  70.00

CURRENT TOTAL : RS. 70

PLEASE WAIT...
*****CURRENT LIST*****
t21  Colgate Paste  70.00
s10  dove shampoo  95.00

CURRENT TOTAL : RS. 165

PLEASE WAIT...

REPEATED PRODUCT SO REMOVED FROM LIST!
TO ADD SCAN AGAIN
*****CURRENT LIST*****
t21  Colgate Paste  70.00

CURRENT TOTAL : RS. 70

☒ Autoscroll
```

Figure 7. Double scanning to remove products

ORDER ID	DATE	TOTAL	VIEW FULL DETAILS
1129	2017-04-25	200	view
1131	2017-04-27	300	view
1137	2017-04-29	95	view
1139	2017-05-03	70	view

PRODUCT ID	NAME	PRICE
s10	Dove Shampoo	95

ORDER ID : 1137

TOTAL BILL AMOUNT : Rs.95

Figure 8. Customer purchase details

Figure 8 represents the detailed purchase of the customer date wise including order id, billing amount, products bought which can be realized from the database.

V.CONCLUSION

Each product in the shop have an RFID tag and each trolley is equipped with a RFID reader. Payment is made by the customer card. The smart trolley system is very efficient for both customers as well as the shop owners. This system is robust and consistent since it can work both online and offline. People always wanted to buy new stuffs to satisfy their needs; however, some people hate it mainly because of the crowd, long queues in the shop, billing, etc. In a big shopping mall, it is very difficult to search for a particular product. In light of these, the smart trolley seems to be a better alternative for all these woes.

In future, this system can be improved further by providing face recognition instead of smart cards. By this, all details are stored online with the customer's face as identity. This makes the customer come to the shop and take a trolley and do all purchasing and can walk out of the door. There is no need of customer's smart card. The bill will be sent to his mail id, and money can be deducted directly from the customer's bank account. However, smart trolley can be improved in security aspect also by providing consumers privacy and it must guarantee secure online transaction.

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