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A Review on Smart Shopping Trolley with Mobile Cart Application

Fiza Mariam[1], Prof. Gowrishankar B S[2], Niharika Nandi S P[3], B S Ganavi[4]
[1, 2, 3, 4]*Department of Information science and Engineering, Vidyavardhaka college of Engineering, Mysuru, Karnataka*

Abstract: ***The modern technology has increased the standard of living for the human. Everyone craves for a quality in everything in our daily lives. Today in the current global scenario the modern technology has increased the standard of living for the human. Demands have been emerged for quick and easy payment of bills in shopping malls. The experience of shopping at a shopping mall is often frustrating because shoppers have to look for items with minimal assistance available. To overcome these problems self-directed smart cart is a solution implemented using RFID Technology.***

I. INTRODUCTION

In this world of IOT (Internet of Things) carrying out tasks have become a lot more convenient with the best efficiency. There is many research of IOT on different applications. We can say that one of the biggest applications of IOT will be smart shopping systems which aim at making the shopping experience fast with easy checking out. Once the item is put into the cart it is automatically scanned and as the customer shops a real-time bill is generated. The store shelves continuously monitor the status of items and reports it to a central server also the same can be reported to the staff as well. This enables inventory management with batch processing. With the adoption of RFID and IOT technologies, such a smart shopping system is only a few steps from becoming true. In current technology customer needs to physically purchase the products, need to search for product, carry cash or card along with them and wait in long queue for making payment. The application which has been designed would read the product id of the product assigned in the RFID and add it to the cart in the application. Whenever the customer puts a product into trolley it will get scanned by RFID reader and product price, RFID tag ID number and total cost of the products will be displayed on the screen. The quantity of the items to be purchased can be changed easily. Then the smart is capable of routing itself to the location of the product. Every purchased products price is to be read by the RFID reader on the Smart-Cart through RFID tag on the product. Concurrent billing and calculation will be done by the website developed. When the shopping is completed, the amount gets debited from the customer's prepaid account. This will save time that was earlier being consumed to scan each item.

II. LITERATURE SURVEY

A. Smart Shopping Cart

In [4] this paper the author has designed a unique system for shopping mall in which the system is attached to shopping cart. The system includes a RFID tag also each product has RFID tag. The billing process is automatically carried out in the trolley itself. The product details such as the product name and product price are displayed on the LCD display. The payment of bill amount is done at the cash counter.

B. Innovative Shopping Cart

In [5] this paper the author has designed a smart way for shopping. This system is developed for a shopping mall in which a RFID tag is replaced by a barcode scanner. The components of this smart trolly includes a RFID reader, LCD screen and Zigbee transmitter. As each product is added to the cart it sums up in the total bill at the end this is stored in the microcontroller memory. The only drawback in this system is the distance barrier which is due to Zigbee.

C. Smart Trolley using Arduino

In [6], this paper the author invented a system consisting of components like ARM7, RFID, Display, Switch, IR Sensor pair, Power supply, Barcode reader Visual Basics. The system used both barcode reader and RFID as well. The shopping process is carried out by implementing the concept of serial communication where the bill is sent to the billing counter and then a hardcopy of the same is generated. The advantage is that the customers can pay through cards or other modes of payment. The main drawback of this system is that the system becomes more multifaceted by the use of both RFID and barcode reader.

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D. RFID Based Advanced Shopping trolley for Super Market

In [7], this paper the author invented a system consisting of various components like RFID, GSM, OTP, Automatic billing, PIC and Zigbee. In this system, the shopping item can be read by the reader and the total cost of the products is displayed on the LCD Screen.

This paper was characterized because many additional features like the displaying of product name and price on the display screen and also the ringing of alarm when item weight is mismatched.

E. Smart Trolley with Smart Billing

In [8] this paper the author developed such a system which included a smart trolley and also smart billing. Additional functionality was included where the system calculated and updated the customer bill every time a new product was added into the cart.

Also, after the shopping process is completed, the customer has to press a key, on pressing this key the billing counter displayed the number of items in the customer trolley on the LCD screen after which the billing has to be done. An updated new bill is generated only when a product is removed from the trolley [9].

Drawbacks: It is a tedious task to attach RFID tag to some products [10]. The other drawback in this system is the distance barrier which is due to Zigbee.

F. RFID-Cloud smart cart system

In this paper RFID was used for billing purpose along with other components like PCB, Wi-Fi, and a power supply to intend the shopping cart [11].

Providing a centralized and automatic billing system this smart trolley system is estimated that it will be capable of bill generation from the shopping trolley itself.

III. CHALLENGES OF PRESENT SYSTEM

It is a time-consuming process to scan details of each n every item.

1) Customers try to estimate the bill total manually before the actual billing takes place.
2) Customers have to wait for a long time in queues to get the billing process done.
3) Barcode scanners need a clear vision of the barcode to scan with efficiency.
4) To read the barcode the barcode scanner must be rather near to it but its shouldn't be more than 10ft.
5) Barcodes don't have the feature of read/write capability.
6) While customers have to wait for some time the barcode scanner retrieves the product information.
7) Every single product must be scanned physically which is a time consuming and hectic process.

IV. PROPOSED METHDOLOGY

The smart shopping system consists of trolleys that are incorporated with RFID readers and in all the commodities present in the shopping complex a RFID card is separately attached that has distinctive RFID number. The moment at which customer places a product they want to buy in the smart trolley, RFID card number of that product is identified by the RFID read which is attached to smart cart.

Each product is linked with its unique RFID card number. The entire information regarding the RFID card and its associated product is stored in a database. This database can be retrieved using a centralized server. The Raspberry Pi Controller is responsible for coordination of all the activities. Each customer is given a membership card. When the customer swipes the membership card, all his login information is displayed on the web application.

The application is dynamically updated as and when the customer places the bought commodities into the cart. The informative details of the commodity are flashed on the screen attached to the trolley. When the customer finishes shopping, he/she has to swipe the membership card again and the server calculates the total bill which would be displayed on the web application. There is flexibility in the mode of payment i.e., the customer can either pay online or even through mobile wallet. After the payment of the bill, the database is updated and the user can leave the store. At the exit gate, the RFID reader and an IR sensor checks the bill for confirming that no non billed product is taken by the customer.

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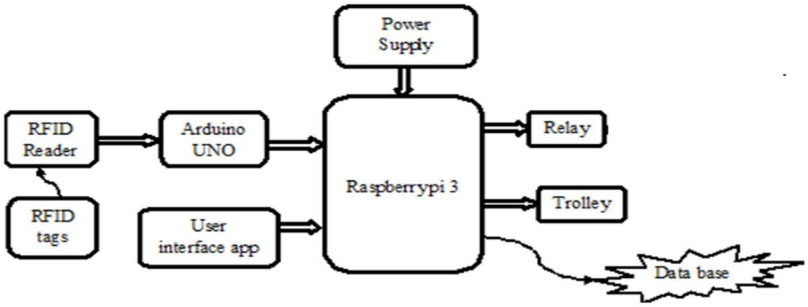


Figure 1. Block diagram of setup

V. ADVANTAGES OF PROPOSED SYSTEM OVER EXISTING SYSTEM

Table 1. Comparison of proposed system with existing system

Existing System	Proposed System
Billing is manual	Billing is automatic
Barcode is used for billing process	RFID is used for billing process
Billing requires human supervision	Billing doesn't require any human supervision
Getting item details is time consuming and hectic to wait in queues	Getting item details is fast and easy and waiting in queue is not required
Item cost is low however overall expenditures are much higher.	Item is little expensive but overall expenditures is much low.
Customers get the final bill at the billing counter.	After customers add new item bill amount is updated at the LCD Screen.

Table 2. Comparison between RFID and barcode

Specification	RFID	BARCODE
Read Process	Radio signals	Optical scanner
Line of Sign	Not necessary	Necessary
Read Range	0 – 50 feet	0 – 12 inches
Read Ratio	Many at once	One at a time
Tag Stability	Can be very long-lasting	Not usually long-lasting
Price	Typically, more costly than barcode	Typically, less costly than RFID

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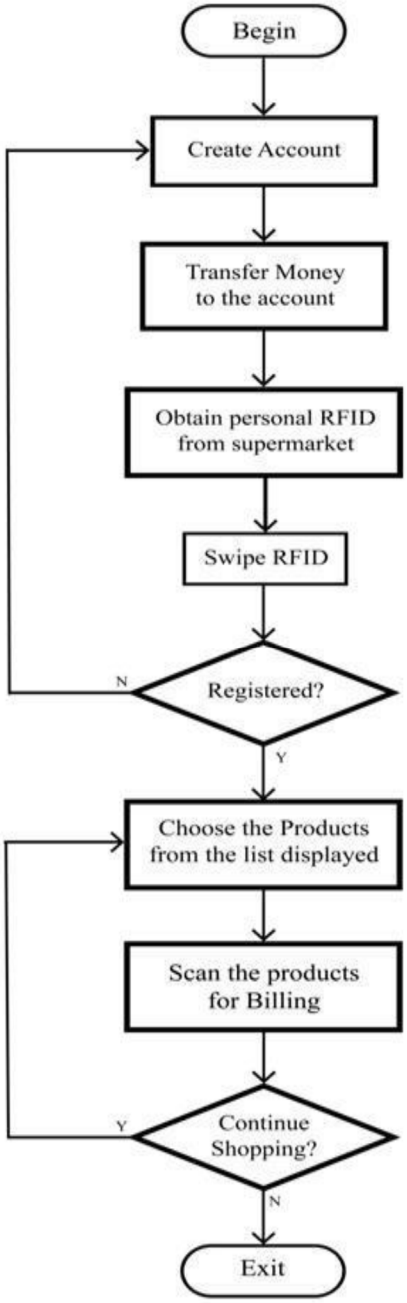
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A. Proposed Architecture Flow

1) *Step 1:* Every new customer gets a unique RFID card by paying the prepaid amount and sign-up.
2) *Step 2:* The Registered customer can initiate the shopping by tapping the RFID card on the RFID reader in the Smart-cart.
3) *Step 3:* The choice to choose between previously purchased history list and new list with the available wallet balance.
4) *Step 4:* The customer can choose the required product list available in the supermarket.
5) *Step 5:* Every product scanned by the customer gets displayed onscreen with its weight, quantity and price.
6) *Step 6:* When the RFID Card reads by the RFID reader the total bill amount gets deducted from the customer's prepaid balance.

VI. FLOWCHART OF PROPOSED SYSTEM

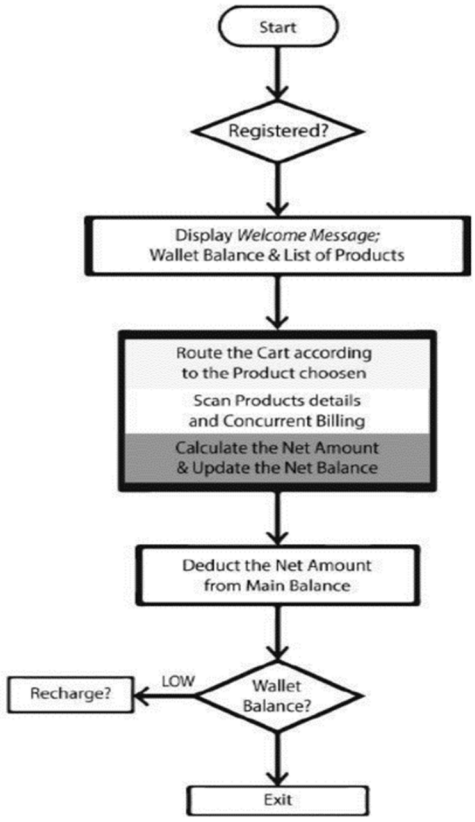
Table 3. Flowchart of functions at the user end



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Table 4. Flowchart of functions at the system end



VII. HARDWARE AND SOFTWARE REQUIREMENTS

A. Hardware Requirements

1) Raspberry Pi 4 Model B
2) Arduino UNO
3) RFID tag
4) RFID reader
5) Relay
6) Power Supply

B. Software Requirements

1) Database
2) Programming languages: Python 3
3) Android App

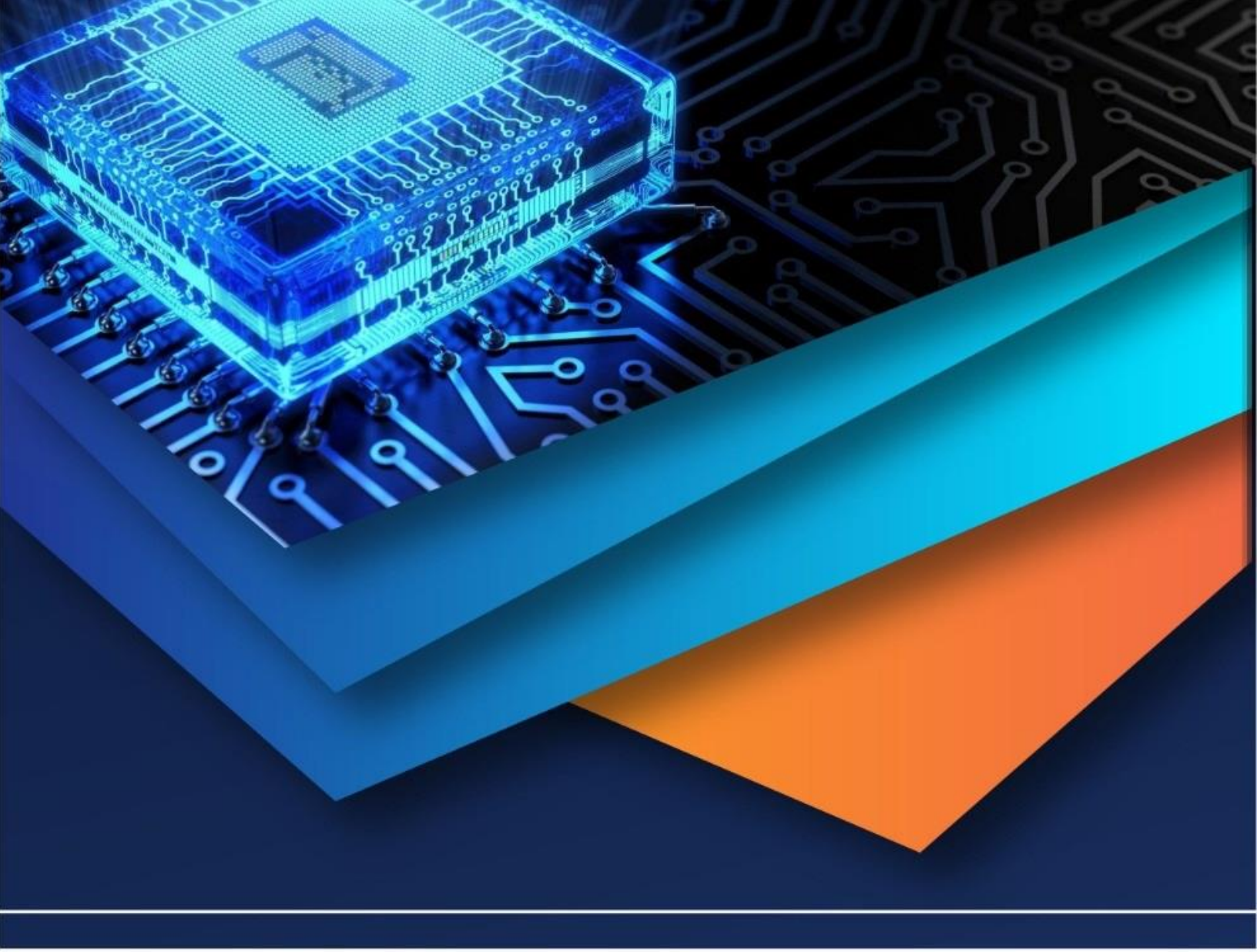
VIII. CONCLUSION

This article is composed after reviewing multiple papers on smart shopping systems. To sum up it can be stated that the shopping experience can be made easy and fast with the use of such smart shopping systems consisting of different controllers. The controllers used can prove to make the systems system bulky on which further research can be carried out. To overcome this issue of bulkiness we can be smart in choosing an ideal controller. Hence, we can say that using Raspberry Pi the shopping systems size can be convenient for shoppers. Also, it will be easy to interface as there is no requirement to add an extra module to interface RFID and the other system components. Using python makes the execution process easier with more efficiency, shorter length of code which is easy to understand and implement.

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