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Self-Billing Smart Cart

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Abstract
Shopping mall has thousands of customers each day. There is huge loss of time for the customers to first search for the product they need and then to stand in the long queue for billing. This project deals with resolving these issues. Upon entering into the mall, the customers have to login into application hosted by the mall where the customers can easily find the products they require. Later after the shopping is done, they can bill the products themselves by using the barcode scanner which is placed on the shopping trolley. The overall sum of the products will be added into the final bill and will also be sent to the customer's registered email id and phone number. The customer can choose either payment by cash or any mobile payment application during the check out at the counter.

Keywords**:** *smart cart, barcode scanner, mobile application, payment method.*

1. Introduction

The customers face problems in spending time searching the products in the mall and also standing in the long queue for billing. With this self-billing system, we can resolve the time and cost related issues. After entering the customer has to log in into the portal/application hosted by the mall. Later the customer can easily search for the products and automatically scan the products and generate the bill. They can even set the budget before shopping, if the budget exceeds then the customer will get intimation. A weight sensor is also placed in the shopping cart to ensure if any product is added without getting scanned. A buzzer is activated if the product is placed without scanning. All this process is controlled by Arduino and sent to the billing counter system through Wi-Fi module. Finally after shopping and bill payment, the bill is sent to the registered customer e-mail and mobile number through the same app. The customers can pay through cash, card or any kind of mobile payments application during the checkout.

The section 2 briefs about the related works of the project. Section 3 describes the problem to be managed and how to bring the solution to the existing problem. Section 4 explains the implementation and the method used to solve the problem. Section 5 contains the results and analysis of the project. The last section has the conclusion describing why it is necessary to implement this project in today's trend.

2. Literature survey

There are numerous researches performed on smart cart billing, few of them are listed in our related works. The authors in [1] have discussed the creation of a smart trolley using RFID(Radio Frequency Identification) reader which will read the RFID tags present on each product in the shopping mall. This paper will describe the proof of the concept of much secure when RFID tags are used to solve the problem.

In this paper [2] they discussed the creation of a smart trolley using RFID reader which will read the RFID tags present on each product in the shopping mall. This paper will describe the proof of concept of much secure when RFID tags are used, i.e., it keeps sending signals if not removed from the product, by which the customer privacy is violated.

The main theme of the paper [3] is to design a basket which allows the users to checkout from the malls and increase the time of production, an embedded chip with barcode scanner and battery is used. The limitation of this paper is that it did not describe an option to remove products if not required once its scanned.

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This paper [4] provides a solution which provides a technological way of implementing barcode scanner to scan the products which is being added and removed from the cart. Load cell is used to monitor the weight, the drawback is that the latency time of wireless communication with server is not considered.

The authors in [5] have described the purchasing procedure in the supermarkets and solutions to the problems. This paper is designed to aid consumers in managing prices and time more effectively. The main disadvantage is that the size of the microprocessor used is limited. It is impossible to include huge database.

The authors in[6] have given a description of using X-Bee module and how database from Arduino is interfaced with the X-bee module. They have introduced a new system by placing a GPS on every cart to locate the customer; the disadvantage of the paper is that it does not help in sharing the total bill with the customer.

3. Proposed Scheme

Self-billing smart cart makes lifestyle comfortable, easier and time saving such as:

- To develop smart shopping trolley and web application that is connected through the Wi-Fi module.
- Helps the customer to set the budget, and if the budget exceeds the limit, the customers get notified.
- Gives the directions as well as the rack number of the product searched by the customer, saving the time of the customer searching for each product.
- Customers can scan the products and generate bill by themselves, not having to wait in the long queues at the billing counters.

By the implementation of this system in any kind of shopping malls, we can improve the speed of searching for the product and billing it by the customers itself. It is more efficient too.

We are using Arduino Uno R3, barcode scanner, LCD screen and Wi-Fi module to perform the operations. Every product in the shopping complex contains a bar code will can be scanned by the customer while adding it into the cart. The customer has to scan the barcode placed on the product from the barcode scanner, then the product details are shown on the LCD display as well as it will be added to the bill. The customer can even set the budget, if the budget is exceeded the customer get a notification. If the customer wants to remove the product from the cart, he has to scan the product twice.

After the shopping is done, the customer can choose any payment method and checkout from the mall. By this the customers can save a lot of time.

4. Methodology

There are three major modules implemented in this project:

Android application

The android application developed will run on the smart phones. In this application, the customer need to login into the application. Once they log in, the dialogue boxes will be displayed with the direction along with rack number of the product, it helps the customer to easily move onto get required products by looking into the rack number in the application. The customer can also set the budget for their shopping, when the limit exceeds the customers get notified. Once the customer selects the cart which has unique ID, the further process will be carried out.

Smart cart

During the shopping, the customer has to select a unique cart using his smart phone then that unique cart ID with customer login details will be sent to backend server with Arduino and Wi-Fi module. The cart has barcode scanner in them using which the customers can self-scan every product and place into the cart. The cart also has a buzzer which gets activated when any product is added without scanning. All the items scanning will be displayed on the LCD screen with the product name, cost and expiry date. And finally after all the shopping is complete, the total bill which is generated is displayed on the LCD screen as well it is sent to the registered phone number and e-mail id of the customer.

Database

All the details of the product are stored in the database. When the product is scanned by the customer, communication is done with the database to know the product details. It is used for the back end processing of the transactions done by the customer.

Product id	Product name	Price	Weight	Manufacture date	Expiry date
5245655	Chips	30	200gms	01-01-2020	01-06-2020
5245656	Chocolate	100	100gms	08-02-2020	08-08-2020
5245657	Butter	80	20gms	12-01-2020	12-02-2020
5245658	Cheese	350	150gms	04-03-2020	04-04-2020
5245659	Milk	40	100gms	08-02-2020	10-02-2020
5245660	Soft toy	120	50gms	16-03-2020	-
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Figure 1: Example of the database maintained for products.

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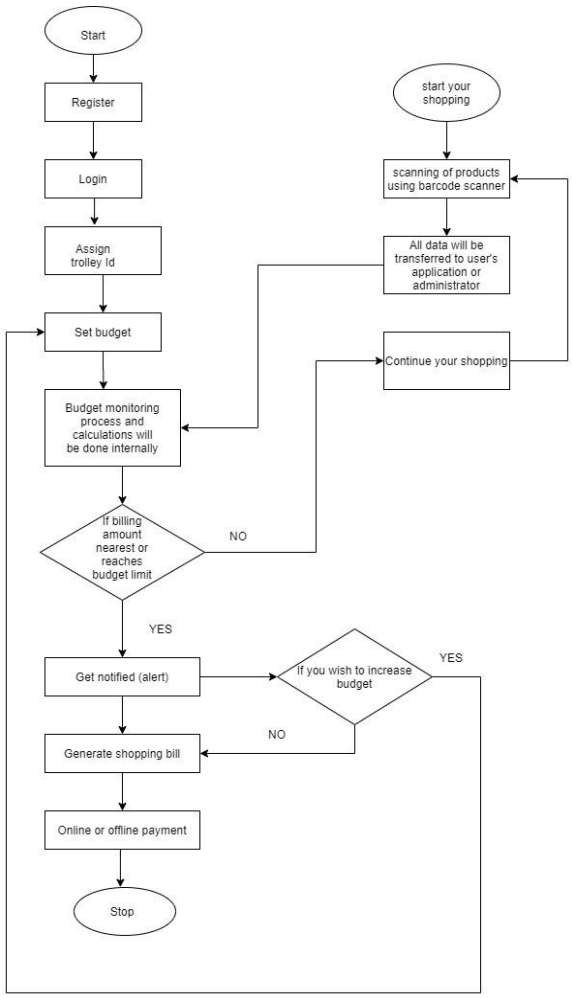

Figure 2: Functions performed during the overall working of the system.

The process of self-billing involves the customer first to register into the application hosted by the shopping mall. The customer can start shopping by scanning the products with barcode scanner and placing it into the smart cart. All the transactions and data will be sent to the user's application also. The customer has to set the budget or limit for shopping. There is a budget monitoring process and calculation happening each time a product is added into the cart by the customer. If the billing amount is nearest or reaches the budget limit, the customer gets notified, then the customer can make a decision if he wants to increase the budget or not. If the customer wishes to increase the budget, he can increase the budget and continue with the shopping. If the customer does not wish to increase the budget, the shopping bill is generated. The customer can choose any payment method and checkout from the shopping mall.

This system can be used in:

- Grocery stores
- Clothing showrooms
- Super markets
- Hypermarkets
- All retail shopping malls

5. Results and analysis

Arduino Uno R3

Arduino is one of the important part of our project, it is a microcontroller which is involved in the overall working of the smart cart and coding. Arduino is mainly used for receiving and transferring the data. It is easy to use, alter and reset the code as per the user needs. Arduino will be given with external power supply. It has a reset button to erase the existing code and re-write the other. The details of the scanned products will be displayed on the LCD and the same will be received by the Arduino and sends back the information to the backend through Wi-Fi module.

Figure 3: Arduino Uno R3

Barcode Scanner

It is a layer based alternative scanner. The barcode allows customer to scan easily and it makes simple to use for variety of processes to scan products. Scanner allows customer to scan the barcode and complete the data transmission when customer presses a single button.

Figure 4: Barcode scanner

LCD display

When the customer scans the barcode with the barcode scanner, then this device displays the product name, cost of the product and also the expiry date of the product.

Figure 5: LCD display

Wi-Fi module

This is a self-contained system on chip with integrated TCP/IP protocol stack that can give the microcontroller

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access to the Wi-Fi network. This is also capable of hosting an application.

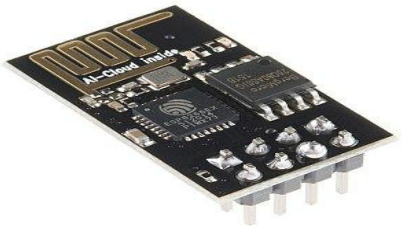

Figure 6: Wi-Fi module

The android application steps are as follows:

Figure 7: Login page

Fig.7. depicts that every customer has to log in into the portal which is hosted by the shopping mall. The customer has to provide the phone number and e-mail id for the first time, as the bill that is generated has to be sent to the customers' registered phone number and e-mail id.

Figure 8: Entering trolley id

Fig.8. depicts after the customer has logged into the portal, he has to enter the trolley id.

Figure 9: Product search prompt

Fig.9. depicts how the customer has to enter the product name to search for any product he requires. The customer need not waste time by searching the product everywhere in the mall

Figure 10: Customer notification for exceeding of budget.

Fig.10. depicts how if the budget set by the customer exceeds, then the customer gets notified. The customer can either increase the budget or stop the shopping according to their choice. If the customer does not want to increase the budget, the final bill appears.

Figure 11: Final bill

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Fig.11. depicts when the shopping is complete, the final bill of the shopping will be displayed. The customer can then proceed with payment and checkout from the shopping mall.

6. Conclusion

By considering the changing trend in the shopping mall , we come into a conclusion that smart cart is very much necessary in the shopping mall for searching the products the customer require and also bill the products by themselves without having to wait in the long queues for billing at the counters. Implementation of this smart cart system in shopping mall is helpful to save time as well as it reduces the work of the employees at the billing counter. Man power can also be decreased at the billing counters. This project is easy and simple to use, so that the customers of every age group can easily understand and get used to this smart shopping technique.

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