Smart Shopping Cart with Automatic Billing System

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Abstract - *Today's world is growing rapidly making human life easier than it already is with every passing moment. Creating a smart cart that takes care of comfort & smart interaction while shopping is one more step taken in the same direction. A supermarket is a place where customers visit to purchase their day today using products and pay for that. The smart shopping cart explores the minicomputers and automatic identification technology. Instant billing without queuing and keeping track of the expenditure is the main motive of this intelligent cart. The aim is to reduce the time spent in the shopping mart and to make shopping of day-to-day items an interactive experience instead of a headache. In this system, every product in the store will have a unique RFID tag, and every cart which customers use will be having RFID Reader attached to it, and customer should have our app installed in their mobiles. It helps the consumers to utilize the time saved in other activities instead of wasting their time by standing in long queues at the checkout counter.*

*Key Words***:** *Smart shopping cart, RFID, firebase, celery, RabbitMQ-server.*

1.INTRODUCTION

The shopping and grocery industry sector is highly important for society. We have witnessed standing in long queues in the supermarket that takes most of our time. During shopping, consumers may encounter many problems like worrying on the bill amount, is it not sufficient, incomplete information about the items they are purchasing. Other than this they must select the best product out of variety of similar products available. Also, the owner wants to revolutionize the shopping mechanism in the supermarket or store to attract number of customers and reduce the labour cost. Furthermore, the unavailability of exact change during exchange starts another round of loitering. The recent evolution in technology and people's understanding towards the technical advancements have made it possible to develop comfort in the shopping industry. We are aiming to develop an autonomous shopping cart which is connected to mobile.

In the market there are similar solutions to this. Developers have made a similar cart with remote capabilities which can automatically fetch the desired items from the superstore while the customer is sitting in lounge and other one is a similar shopping cart with a tablet attached to it. Even though these are good solutions but there are not cost effective and user attachment is not great in these solutions.

In the recent years we have witnessed the interest in RFID and supporting technologies to identify products. Similar technology can be applied here for unique identification of each product in the supermarket. Rapid growth in RFID technology is making impact on many sectors and has a good influence on industries. As the working of RFID is wireless, RFID makes the conventional retail process fast, transparent, and efficient.

Every product in store will have a RFID tag, and every cart will be having RFID scanner/reader attached to it. The RFID reader are non-contact sensors that can read over a considerable distance. When the customer enters the store, he/she should open our web-app which will be connected to the shopping cart through valid credentials. The items can be added just by dropping the item into the cart, the reader reads up the RFID tag attached to the item. Removing the item from the cart which can be done by taking it out of the cart which has the RFID tag attached with it. These actions are displayed in the web-app, so the customer can know the items currently in the shopping cart in real-time. The cost of each item dropped into the cart is displayed along with the quantity of each item purchased.

The web-app which will be in sync with the shopping cart and will get updated in real-time.

We use the real-time database of Firebase to facilitate our process of displaying the items in real-time. During the process of shopping the customer can see the total cost of the products in cart in mobile and then can stop or continue shopping based on the budget available. When the cart reaches the exit of the mall, the application redirects to the payment gateway or deducts the amount from the wallet.

This Smart shopping cart mainly focuses on the user interaction with the cart during shopping. In the market there are no existing solutions like the shopping cart connected to mobile which displays purchased items in real-time. Further development in the app can make the interaction better and can eliminate the helper intervening in the shopping process. This paper consists of the methodology of the implemented product, real-time and result analysis, and limitations of the smart shopping cart.

2. Literature Survey

PAPER	JOURNAL	SURVEY
Micro-controller based Attendance Management system	International Journal of Engineering and Innovative Technology (IJEIT) Volume 5, Issue 10, April 2016	Attendance Monitoring System (AMS) helps us to control labor costs, minimize compliance risk, and improve workforce productivity. It is also reduces the administrative time associated with attendance exceptions and employee inquiries. Attendance Management System is proposed using Radio Identification (RFID) Frequency tag and fingerprint reader. The system takes attendance electronically with the help of the RFID and finger print device.
Ingenious Shopping Cart: RFID Enabled Automated Billing using Raspberry-pi	International Journal of Computer Science and Mobile Computing, Vol.5 Issue.5, May- 2016, pg. 209-214	The paper is based on development of a project with the aim to reduce the time spent in the store and to make shopping of day-to-day items an experience instead of a headache. This cart uses modern and cheap technology like RFID and minicomputers to make it intelligent and time saving. It helps the consumers to utilize the time saved in other fruitful activities instead of wasting their time by standing in long queues at the checkout counter.
Raspberry-pi Image Processing Based Economical Automated Toll System	Global Journal of Researches in Engineering Electrical and Electronics Engineering	Implementation of image processed toll systems are only limited in some places. A camera will be used to take picture of the vehicle's name plate to sort the toll charge according to vehicles category. Along with multiple automatic tolls taking booth there will be a manual booth with operator also who will handle those vehicles which experience issues with any of the automatic toll taking booth.

3. PROBLEM STATEMENT

When we visit a supermarket for shopping, we spend enough time in selecting the right product, after that we spend even more time in standing in queue for billing at the checkout counters. In the case of weekends or during festival seasons when everyone come to shop, we have to wait even more due to the heavy crowd. To eliminate waiting time and have greater interaction during shopping we need a smart shopping cart to eliminate all these problems.

3.1 Objectives

- Update web-app when item is inserted or removed from the cart.

- Display cart items in real time.

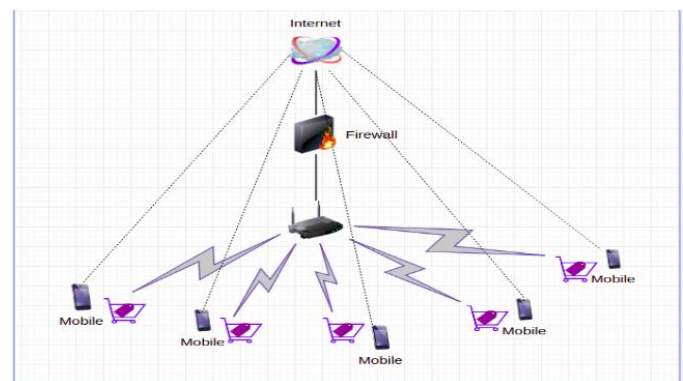- Automatic billing when cart moves out of the shop.

4. METHODOLOGY

Fig -1: Central Automated Billing System

4.1. Model Building

1. The total system was built on Agile model.

2. Initially the requirements were noted along with the dependencies required.

3. Survey was done for the required components.

4. As every item in the supermarket requires a RFID tag, we have to choose a tag which is cost effective.

5. As every cart in the supermarket requires a RFID reader, we have to choose a reader which has the capability to read multiple tags and read over a distance equal to the size of the cart.

6. Every customer to use the produce must possess an app built by us to use our shopping cart.

7. Customer has to open the app before entering the supermarket and scan the QR code on the shopping cart in order to sync with the cart.

8. The shopping cart must be capable of reading multiple tags and software adjustments has to be made for this feature.

4.2. Model Implementation

1. Interfacing of NodeMCU and RFID scanner is done using the jumper wires.

2. Interfacing between the App and the NodeMCU using firebase.

3. Two NodeMCU's are connected to Raspberry Pi for processing and sending the data to firebase.

4. NodeMCU is programmed to connect to a local Wi-Fi network and RFID reading capability through Arduino IDE.

5. NodeMCU data can be read into the raspberry pi with the help of tty0 (a terminal for reading and writing data).

6. Pyserial module in python is used to read commands from NodeMCU.

7. Raspberry pi is also connected to the local WIFI network, which runs the server to send the data read through RFID readers into the firebase server.

8. When an item is pushed into the firebase, we have to wait till we get an ack message, then only we can send the next item. In our scenario as many items could be added/removed at once we have to maintain a task queue to store all the requests and execute each task one by one.

9. To avoid errors in pushing data to cloud, we use an asynchronous task queue Celery, which puts the tasks in queue and executes each one independently.

10. To facilitate the Celery queue a broker called Rabbit MQ is used, which connects the backend to Celery.

11. Only the item ID is sent to the firebase database. When item is received in the app, it is matched with the local database which contains all the details of all the items.

12. Then both the Raspberry, NodeMCU and the RFID scanner are powered up using an USB cable which can be seen by blinking of LED in both of them.

13. Then once the entire circuit is made the RFID tags are kept near the RFID scanner for scanning.

14. As soon as the scanning takes up, module which is running on Raspberry Pi displays the ID of tags which are scanned and likewise we can see the product getting displayed in our shopping app.

15. This can be done multiple times and finally the total amount to be paid by the customer is displayed on the screen along list the list of all the products and their respective prices.

16. If we want to remove the product in the cart, we can just remove it, as it is scanned before once inserted, if the same item is scanned again means it is removed from the cart.

17. After successful shopping customer moves out of the shopping complex and the app redirects into any payment gateway (Paytm, Phonepay etc.) which the customer completes the payment.

Thus, these above-mentioned steps delineate the detailed working and methodology adopted in our project which enables any customer to experience a smart shopping experience without interacting with any employee in the supermarket or the store.

5. RESULTS AND ANALYSIS

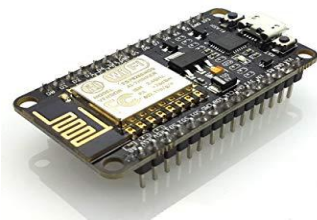### 5.1. Tools used in this Project

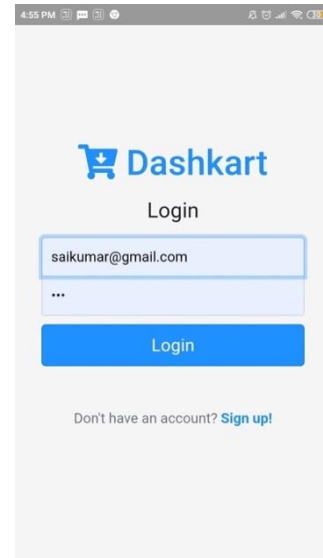- Raspberry Pi - This contains the Rasbian OS for running the programs.

- RFID Reader - This scans the RFID tags.
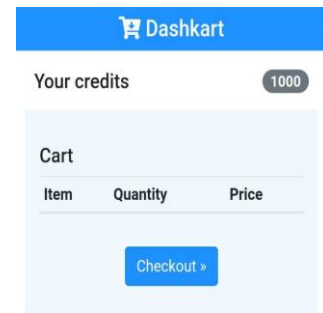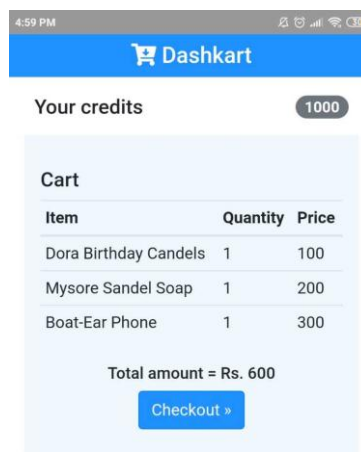

- NodeMCU – WIFI module

5.2. Screenshots

- Shopping Cart – I

- Shopping Cart – II

- Mobile Application Login

- Empty Cart

- Items added to cart

- Case when item is removed from the cart

5.3. Usability Analysis

Questionnaire asked to various users.

Results obtained from the Questionnaire.

5.4. Limitations

- Range of the RFID scanner used is up to 2cm, so the item has to be scanned very closely to RFID scanner.

- RFID tags can be damaged, hence can be made undetected by the scanners.

- RFID reader used can't detect multiple RFID tags at once

- Requires continuous power supply and proper WiFi connection.

5.5. Time-Delay

- Since the app and cart works in real-time the overall time delay is around 1.5-2.0 seconds.

6. CONCLUSION

This application creates an automated central bill system

for supermarkets and mall. It helps in keeping the shopping experience good by displaying the total cost of the products to the customer. Suppose the product is removed from the cart, it must be also removed from the bill too. It will also enable online transaction procedure for billing. The ongoing trend of online shopping, which reduces the hassle of shopping offline at stores, introducing smart carts may not only be able to eliminate the surge but contributes to the reduction of the usage of paper bills making environmentally friendly, & saves time wasted in standing in long queues. This also makes it more economical viable for the owner to manage fewer staff.
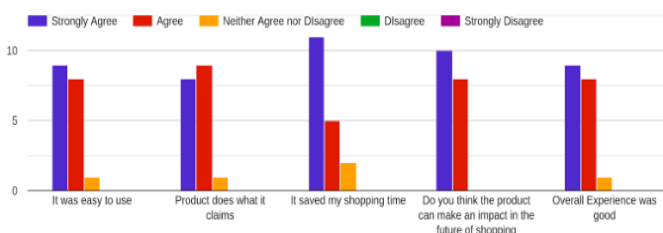
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