IoT based Smart Shopping Trolley with Mobile Cart Application

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Abstract- Even through e-commence and other online applications are growing rapidly the craze for traditional shopping has never stepped back. One difficulty is to follow up in a queue for the billing process. There, arises a demand for easy and quick payment of bills. The proposed Smart Cart in this paper, is capable of generating bill using IoT along with the mobile cart application. With the use of this mobile application and trolley, customer can make bill payment in no time. The smart cart uses the RFID tag and receiver to scan the product, load cell to prevent theft, LCD display and the Raspberry pi. Along with this the customer can also log in with the mobile app which will display the list of all the products mentioned and their amount. Once done, the customer can pay the bill through the mobile application.

Keywords: Raspberry pi, Mobile-cart, Smart trolley, IoT

I. INTRODUCTION

The dynamic growth and the advancement of the new and exciting system has grown rapidly. On the other hand, Shopping centers or malls provides a great convenience to consumers, where all the products of varying choices are found under one roof. Shopping has become very usual and it is no more a luxury but a basic need [1-3]. Customers face lot of difficulties during shopping, one of those is waiting in the queue to just bill the products and most of the customers are budget shoppers. Most of the time only at the end they would know that the bill is higher than the budget value and difficulties occur in removing the products. Most of the times, shoppers are not able to buy all their required products and miss out few. Secondly, now-a-days shoppers are more comfortable to buy from home rather to go to the shop with the list written in the small piece of paper. Then, locating the products here is the next difficulty. Over all this is totally a time-consuming process [4-5].

So, we come with the better solution for both the shoppers who like to buy online and to those who wish to come and shop in the shop. This smart shopping trolley consists of the RFID reader that reads the tags of each products of which customers wants to buy before the product is dropped into the trolley. The LCD display mounted in the trolley will display the scanned products and the amount. So, the customers can buy within their budget and need not wait in the queue to get billed their products. Then, the application is designed in such a way that the customers can buy their products through online and from their regular shop and the regular items. The bill payment maybe either online or through offline based on the customer's choice [6]. The product details are updated from the front end, that is from the respective shops. so as soon as the customer opens the application, they would see all the details like available products, quantity and amount. Our proposed system overcome all the problems faced by the customers in the exciting system in a highly billing efficiency and the application helps the customer to choose the product with ease.

II. LITERATURE SURVEY

At present, the process is done by using bar code scanners in malls where the vendor scans the product through the barcode scanner. This is considered to be to be a slow process and Customer has to wait in long queues[1]. The Arduino based smart cart in which the designed cart eliminates the efforts such as self-packaging and makes the use of cart storage and involves the security system for theft control [2]. Most of the works regarding the trolley discusses about the development of RFID with ZigBee system to establish the wireless communication between each RFID (916-924MHz) and main server main server. The shopping communicate through low-power Bluetooth (only uses ¼ of power in contrast to Zigbee, hence increase battery life for the same cost.[3]The advantages of proposed system over conventional

systems are: it is reliable to use RFID tag instead of barcode scanner, security measures like prevention of theft, managing the purchase within the estimated budget, easy billing, no long queues, backup security and check, online purchase with home delivery option and offline purchase(can be fully done by customer or customer can send the desired items via mobile application to shop, can head to the shop just to check the items and can pay the bill in trolley using QR code or can pay by cash in the bill counter) [8].

From the literature survey, problems in the existing system have been identified and the modifications are made in the proposed frame work. The rapid growth and emerging of new and exciting system have grown instantly. The process is slow when the products are scanned by using barcode scanner. The present system consumes time of the customers by waiting in the queue during the billing process which makes the lack in the entire shopping process. This is due to the lack of billing system. Theft and dropping of items in trolley beyond the customer's estimated limit is also major problem [7].

III. PROPOSED FRAMEWORK

Our proposed system makes the billing very simple, stable and as well as reliable. Customers doesn't want to wait in long queues for getting billed whereas bill can be generated automatically by using IoT [9-10]. Customers can easily pay the bill in the cart by using QR code or just sit at home and shop through the mobile application-ordering facility through mobile app along with smart trolley is the main advantage. Trolley consists of the RFID tag, that is unique to the products. Products can never be put inside the trolley without being scanned as the load cell is present in the trolley, thus to prevent theft or some errors. Also, as a backup, a security check is done with the items sent by the customer through mobile app with items displayed in trolley with LCD display. According to the customer's convenience, the payment can be made:

- ▪ Through mobile app

- ▪ By scanning QR code present in trolley

- ▪ Traditional method by using cash or card payment

A. Hardware implementation

Cart Design-The system we proposed is the automatic billing from the cart or from the application that we have developed rather to wait on the long queue. The cart consists of RFID tag that is read by the reader and then placed in the trolley

and the list of items are displayed in the LCD display that is attached to the smart trolley. The load cell is also included in it to prevent the theft along with the buzzer that beeps when the product is placed in the trolley without scanned.
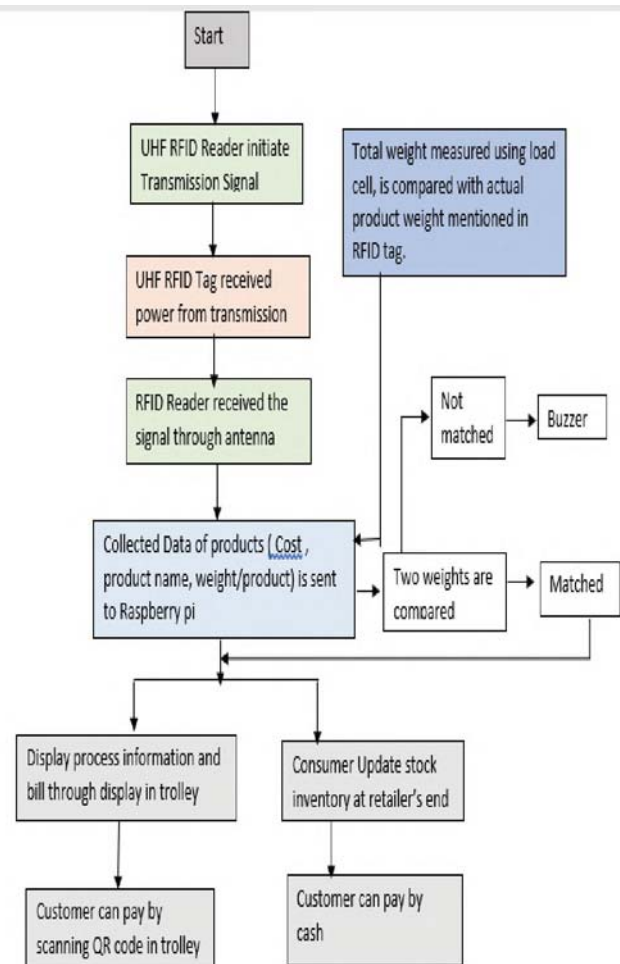

Fig 1: Flow of proposed framework(hardware)

Microcontroller-Raspberry pi is the tiny microcontroller that let us to build a hardware with some code running and centrally controls all the devices connected to it. It is fed with the code and connected to the power supply. The devices are triggered according to the flow of the code. With the application of IoT, it sends the data of purchased items to the database (Billing counter). Raspberry pi is much faster than Arduino which is about 40 times in clock speed. The RAM of pi is 28000 times more than Arduino. It also has Bluetooth and wife modules.

RFID tags and reader-All the products in the shops are provided with a unique RFID tag instead of a barcode. Each shopping trolley has an RFID reader. RFID operates at 13.6

MHz frequency and can operate hands free in any environment making it a wise choice as an RFID reader for a supermarket or shopping mall trolley. UHF RFID can be used in large scale because, its frequency range is high. Separate battery source is not needed for RFID passive tags. Each trolley is reinforced with an RFID reader, and the type of reader that is used is RFID-RC522. It is a low-cost RFID reader which can also write data into the tags if required and can be directly loaded into the reader module for modulation and demodulation of signals.

LCD display-An LCD screen is to display all information related to the item that is scanned and added in the cart already. The billing option is given in the display itself to quick and instant payment rather to wait in the queue. A 3.5-inch LCD Touch Screen Display for Raspberry Pi is used for displaying code. Raspberry screen can display a multitude of alphanumeric characters and graphics on its screen. It is connected to the I/O port of Raspberry pi and can display information in real time.

Load cell with amplifier HX711- A Lightweight high resolution strain gauge loadcell wall will be placed at the bottom of the trolley, just behind the deformable element which is used to check continuously the weight of the trolley to reduce the customer's error while scanning and also to prevent theft.

Buzzer- It is an audio signaling device. It will be on when the actual quantity weight and billed quantity weights are mismatched which is checked by load cell. It is used here just to indicate the customer's error or can prevent the theft.

B. Software implementation

Application design-The application is developed in such way to give a real shopping experience to the customers in no time. Customers have to login to the app and can add the items to the cart that they need to buy form the respective shop. Once the product list is chosen by the customer, that list is sent to the admin. Customers can pay either by online or by cash or can be delivered to home according to customer's wish. Once, the admin receives the list, he/she is allocated with a trolley number and the attender's Id, which is also displayed in the mobile application.

Software tools required-
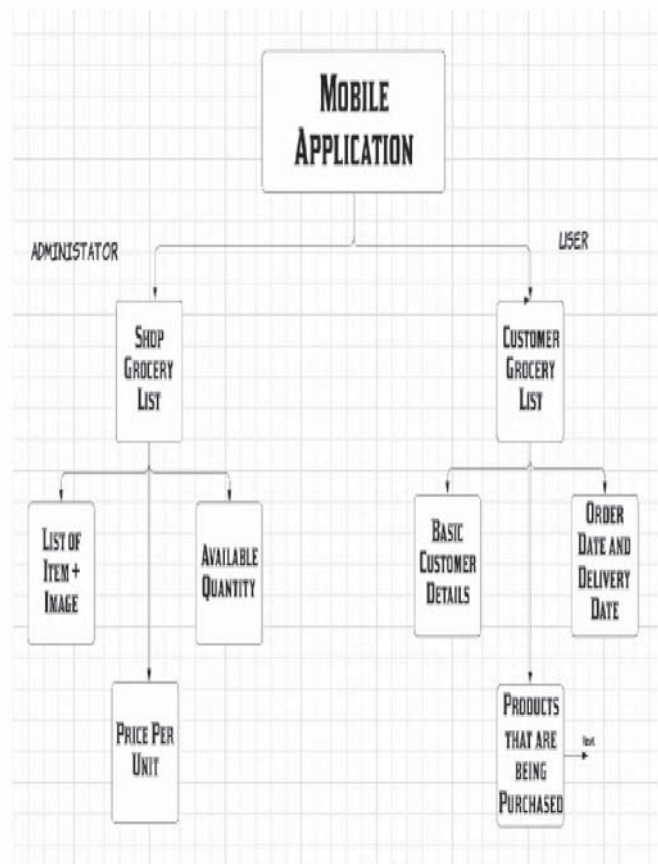- Android studio
- Python idle
- Tkinter GUI
- Mysql Database

Fig 2: Proposed framework (Software)

IV. RESULT AND DISCUSSION

Based on the proposed framework, smart trolley with automatic billing, theft prevention or error avoidance using Raspberry pi, load cell and buzzer is made and the billed items are displayed in the LCD display mounted in the trolley. The following are screenshots from the mobile application "mobile-cart" where the grocery items selection, mode of payment, as well as attender's Id and trolley number can be displayed and accessed by the user. Whereas from the admin side, collection of grocery list and updating the available grocery list to the customer, and allocation of attender and trolley number to the customer can be done.

Fig 3: Users info page

Fig 4: Cart of customer

Therefore, according to the consumer's wish purchasing can be made either online or offline with more ease and in efficient way.

V. CONCLUSION

In, this paper we have successfully demonstrated the system of RFID that would be the best replacement of the traditional barcode scanner. There are many drawbacks in the barcode scanning process like the scanner must be placed in certain distance and inability to update information. Finally, there is an end to the long queues. successful use of RFID and loadcell system of smart shopping trolley with cart mobile application has been demonstrated. The drawbacks

addressed in previous applications such as theft prevention, data storage, has been overcome in this application. Though, the man power is required but it attracts many customers because of various available options particularly meant for the corresponding shop.

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