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Smart Shopping Trolley Using Raspberry PI

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Abstract**—** *Now a days, purchasing and shopping has turned into a daily need. Customers who need to purchase different products from supermarkets or malls needs lots of time for billing which increases the queue length at the counter. This paper deals with a model of smart shopping system where the bill is automatically generated in the trolley. As and when the customer scans a product and puts it into the trolley, the system connected to the trolley will prepare the bill respectively. By using this model the time consumption of billing can be prevented.*

Keywords**—** *billing, automated, LCD display, barcode, database, button, billing counter, ZBar.*

I. INTRODUCTION

Humans want to decrease the tasks using the technology in a easier way. A main thing where the humans spend maximum time is shopping. Shopping needs more time which includes the long queue.

All the supermarkets and malls will have a shopping trolley and baskets for the customers to purchase the products. After shopping is done customers have to move to the billing counter. Here billing process consumes a lot of time to checkout from the billing section. In this smart shopping model an innovative shopping cart is connected within automated billing system. This will reduce the customer's time and decreases the man power at billing counter.

To the automated billing system, mainly we have connected an LCD display, camera and a loadcell. Few buttons are used to add the product, to delete the product and to generate the bill. To the raspberry pi the database is fed with the dataset of some of the products in the shopping market. The algorithm used here plays an important role in converting camera to a scanner to read the barcode. The customer has to scan the product and then put it into cart. The selected product weight and the stored database weight has to match to generate the bill. After the shopping, the button has to be pressed to generate the bill which will be sent to the customer's mail and to the billing counter for final payment.

II. LITERATURE SURVERY

Archana Nikose et al. [1] proposed a system where the customer is given a card to scan the barcode which generates a unique id. Later the bill details is displayed on the screen and has to pay through online.

Vishwanadha V et al. [2] proposed a system which is using raspberry pi based system with a barcode scanner where the customer has to pay the bill through online payment like GooglePay, Paytm etc.

Ashok Sutagundar et al. [3] proposed a system of RFID tags [Radio Frequency Identification] but the shopping information is passed on to the Amazon cloud using the Wi-Fi module and the data is sent to the android application of customer's to pay the bill at the counter.

Agarwal Isha Sanjay et al. [4] proposed an IOT based automated trolley where each product is tagged with RFID. The bill is sent to the counter using wireless system.

Raghav Chadha et al. [5] proposed a system that utilizes RFID with the billing side using mobile applications. The billing information is sent to the customer through mobile application using Wi-Fi module.

Tharindu Athauda et al. [6] has proposed a system which is low-cost, robust, passive UHF RFID based shopping system. It uses UHF antenna mounted on shopping trolley and products are tagged with UHF-RFID.

III. METHODOLOGY

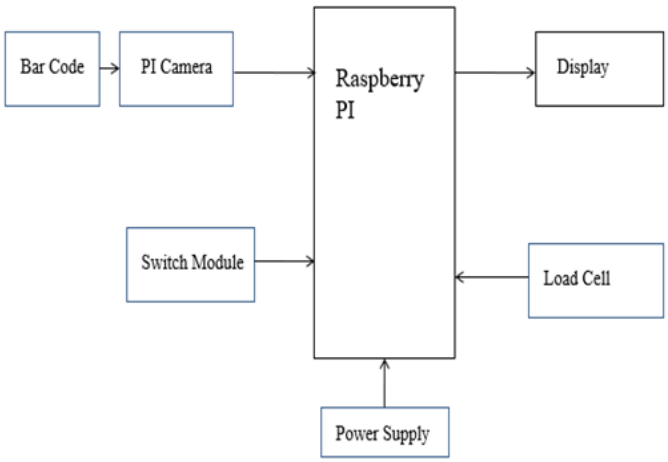

Fig. 1. Block Diagram of Smart Shopping Trolley

A. Power Supply

Raspberry pi uses dual power supply one of 5v and one of 12v.Stepdown Transformer is used which converts 230v 50Hz to regular voltage. The block for designing a power supply are Transformer, Bridge rectifier, Filter and Regulator.

B. Barcode

Barcode represents the data in a visual, machine readable form. Barcode consists of rectangular or square image which has parallel black lines and white spaces of varying width. For the quick identification the barcodes are applied on products. It can be generated quickly and easily.

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C. Pi Camera

Pi camera is a portable light weight camera. It uses MIPI camera serial interface protocol to communicate with Pi. Pi can be used to take photos or record video's using simple python scripts. Open CV is installed in Pi camera to act as a scanner and this open CV uses ZBar algorithm.

D. Switch Module

Switch module allows to add expansion modules for the network requirement changes. They provide with a most flexibility, but at a higher cost. They also allow for additional interfaces, power supplies or cooling fans. These switches are application specific and include those for firewalls, wireless connectivity.

E. Raspberry Pi

Raspberry Pi is a low cost, credit card sized computer. Raspberry Pi B is the earliest model of the third generation Raspberry Pi. It provides a set of GPIO(General purpose input/output)pins. These GPIO pins controls electronic components for physical computing and to explore the internet of things. A powerful feature of Raspberry Pi is GPIO pins. USB devices such as keyboards and mouse can be connected via USB ports.

F. LCD

LCD produces a visible image by using liquid crystal. LCD is capable of displaying special and even custom characters, animation and so on. It is energy efficient and this can be disposed of more safely. A 16x2 LCD is used where it can display 16 characters per line, where there are 2 such lines. LCD displays the information like name of product, cost of product, budget and total bill.

G. Load Cell

The load cell is used for the measuring weight of the product in which 5kg signifies the measuring capacity of the load cell. The weight of the Load cell is synchronized with the scanner. Load cell gives an output voltage which is almost proportional to the weight due to factors such as repeatability and temperature effects.

H. Buzzer

When there is a weight mismatch between the product weight placed in the trolley and the weight of that product in the database there will be a alert notification from the buzzer. It also gives alert notification when theft happens. The buzzers are used for alarm devices, timers and confirmation of user input like mouse click or keystroke.

I. 4x4 Keypad

4x4 keypad matrix is used as a method of feeding the input. The keypad module is matrix of nonencoded keypad consisting of 16 keys in parallel. Matrix keypad is used to set the shopping budget by the customer.

IV. Flow Chart

Flow chart represents the work flow or process. It can also be defined as diagrammatic representation of an algorithm. They are used in analyzing, designing, documenting or managing a process or program in various fields.

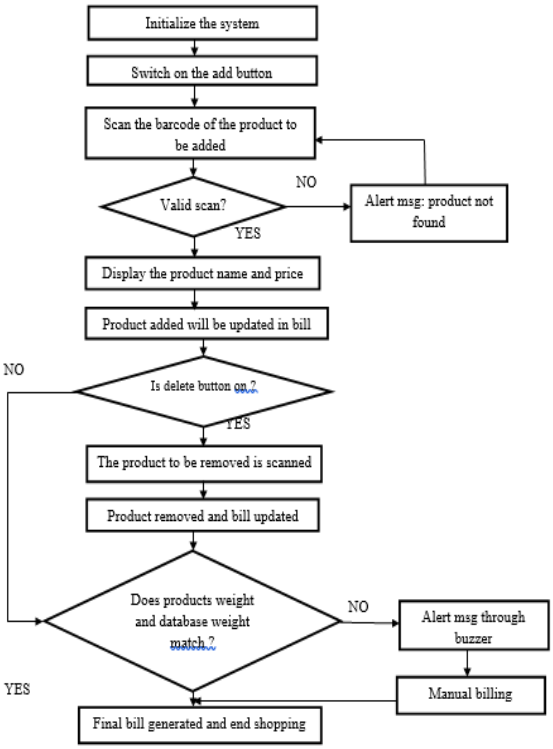

Fig. 2. Flow Chart

IV. Implementation and Results

The model consists of IOT as hardware and python 3.8.1 as software coding. The project datasets consists of a product details such as product name, product weight, cost and ID of the product which is stored in raspberry Pi database. This information can be used later for fetching details of the product from the database corresponding to the barcode. The project uses ZBar algorithm to encode and decode the barcode. ZBar is an open source software which helps to read barcodes from various sources like video streaming, image files and raw intensity sensors. Attributes of ZBar are high speed, small memory and unlimited images. The Pi camera uses an OS called Open CV. Open CV is a cross platform library which used to develop real time computer vision application and it is used in image capturing.

The steps are as follows:

a. Initialize the system i.e. power up raspberry pi, LCD, load cell.
b. To add a product into the trolley, switch on the add button.
c. Scan each product and add it to the trolley, the corresponding product name, price, weight and Id will be displayed on the LCD.
d. Once all the products are scanned switch off the add button.
e. If any of the products need to be removed, switch on the delete button and scan the product to be removed and then switch off the delete button.

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f. After the shopping is completed, to pay the final bill in the counter, switch on the billing button.
g. The bill will be generated in the main server (counter) where the bill has to be paid.

Each trolley in the shopping mall is given a unique ID and the customer will take the trolley and should enter the budget for shopping. When the customer picks up the product s/he should switch on the first button to scan the barcode of the product using the pi camera which is attached to the trolley and then places it in the cart. If there is difference between weight of the product placed in the cart and weight of that product in the database then there will be notification from the buzzer. If matches, the shopping can be further continued.

To add the multiple items the user has to switch on the second button. After switching on the second button the quantity of the products should be entered. If the user wants to remove any particular item needs to switch on the third button and has to scan that product which will automatically delete the product details from the billing database. If the shopping budget exceeds the entered budget then the user has to re-enter the amount. After shopping all the products the customer has to switch on the fourth button to generate the final bill. If there is discrepancy in the weight then the user has to go for the manual billing. When the bill is generated the bill is sent to the customers mailid and to the billing counter through Wi-Fi.

After scanning the product the product details will be fetched from the database and will be displayed on the LCD as shown below.

Fig. 3. Product Details Displayed on LCD

When the product is deleted the information of the same product will be deleted in the billing database and displayed on the LCD as shown below.

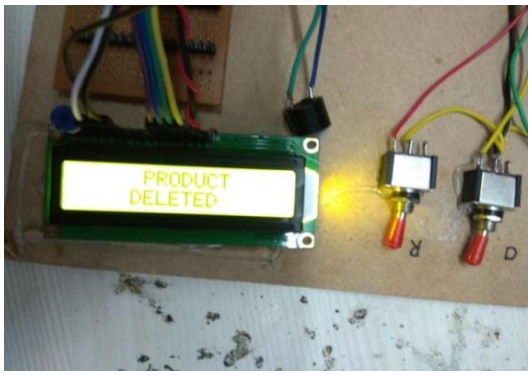

Fig. 4. Message Displayed on Removed Product

After the bill is generated the total bill is sent to the user mail id through which user can directly pay the bill.

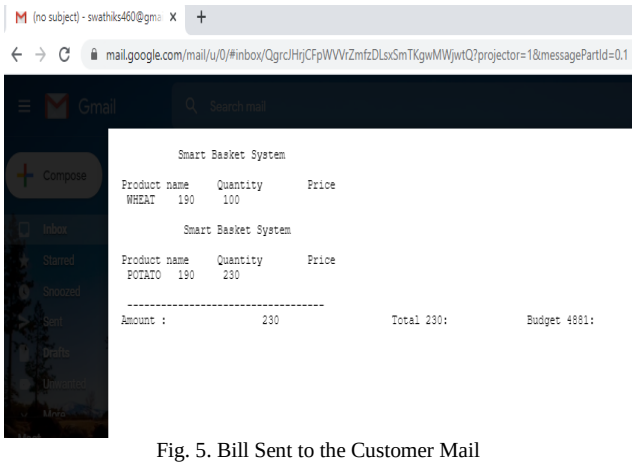

Fig. 5. Bill Sent to the Customer Mail

Advantages:

1. Eliminates the time spent at the billing counter while waiting in a long queues there by reducing the checkout time and increases customer satisfaction.
2. Reduces the man power required at the billing section. This can reduce the incurred by the management.
3. It helps in detecting any kind of discrepancies such as theft.
4. Pi camera can be used to scan different types of barcodes.
5. The total bill amount is automatically sent to the billing counter and to the customer through mail. So it is an user friendly system.
6. User can re-enter the budget when the estimated budget has exceeded.

Disadvantages:

1. In large scale the initial installation cost of the trolley is high when compared to normal shopping trolley.
2. The removal of products from the trolley or continuation of shopping is not supported once the products are billed.
3. Security threat, user can replace the scanned product before placing into the trolley which has same weight of the scanned product.

V. CONCLUSION

The proposed model can be easily used by the user which decreases the time required for paying the bill. As each product is added to the trolley bill will be automatically generated. As the whole system is becoming smart, the requirement of man power will decrease thus benefiting the retailer. In the mall, theft will be controlled using this smart system, which adds the cost efficiency. The time efficiency will increase phenomenally since this system will eliminate the wait in queues. As the total bill amount will be sent to both billing section and to the user, so user will directly pay the total bill. This model can be used in any supermarkets, shopping malls, clothing showrooms and provides user friendly shopping system.

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