SMART SHOPPING TROLLEY FOR AUTOMATED BILLING PROCESS USING IMAGE-PROCESSING


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ABSTRACT

Regardless of the how many of E business gets involved in individuals E-Business in generally purchasing numerous items just from markets and shopping centers for the purpose of their own fulfillment and basics needs. Though there are many problems faced by the customers and Among the troubles faced by the customers there is one problem which is to go through the line for the process of billing. Although the goal is to simply to get a couple of items or may be single item, while standing in the line to get bill for the items which consumes the customers time. By the basics of the review and giving out cash or money and normal time spent on every customers is more time consuming, particularly in packed grocery stores shopping malls, mores. The IT people or customers who prefer new technologies to be implemented are prepared to welcome any new technology which automates the billing process which decreases customers time and waiting time and the time spent for the process of billing. This principal point is to fulfill the basic needs of the customers and furthermore to reduce the time spent on the process of billing process, which is to finish the process of billing in the trolley instead of waiting in a line to buy couple of items. Like Supermarkets and general stores which have been in business for decades, are usually and all the groceries which are fresh fruits and vegetables are bought from supermarkets or general stores. A supermarket is a place to get everything you need including your breakfast related items like bread, eggs, snacks, lunch and dinner all the basics stuff which are required for daily needs of customers. Various implementations have been introduced to avoid shoplifting and to make it easier, convenient for customers for the process of shopping or for their basics needs. But one disadvantage of supermarkets and general stores is to wait in line for the process of billing. In this paper, the authors have proposed just walk through of the technology which would be helpful for the process of easy shopping process using Raspberry pi and other technologies. Our system is appropriated for the use in general shopping centers such as supermarkets, D-mart, Big Bazaar, Walmart where this technology can help in reducing the time consumed and in making shopping experience better for the customers.

Keywords: Smart-Shopping, Raspberry-Pi, Shopping Trolley, Image Processing, Machine Learning, Artificial Intelligence.

I. INTRODUCTION

In the 21st century, technology which has been advancing to a quite different level, due to centralization and modernization of the Industry 4.0 technologies and its implementations, everything has been automated and modernized. Researchers and scientists are working hard to make the surrounding smarter and modern. To have a good shopping experience, the term supermarket or shopping marts or shopping malls came into use and the things basic necessity things started getting available locally in one place such as supermarkets or wall marts. The Shopping centers like Walmart’s, D-marts, Big-bazaars started, and online shopping has helped the economy boost over the top during Industry 4.0. With the traditional billing process service, slow and inefficient paper billing was replaced by bar-code scanners, along with this billing process systems, the customers for the billing process also increased and the customers were not comfortable as the time passed the customers would get frustrated due to long wait in line for the process of billing. Various projects like smart cart using RFID & NFC were introduced recently, but none of the tags were effective enough to meet up-to the level of modernization, amazon decided to open its own smart grocery store called ‘Amazon Go’. It uses technology like computer vision and deep learning and machine learning algorithms. We have decided to build a similar framework using image processing and raspberry-pi in a cost effective way.

A. Amazon-Go

The “Amazon-Go” stores have been built in more than 12 cities all around the world. These Amazon Go are the first store of its kind where there is no checkout required. Customers simply enter the store using the Amazon-Go app and Amazon-Go shopping cart to browse and pickup the products customers want and after picking up the products which want and leave the store. The store is partially automated and partially Human supervised, with its customers being able to purchase the products without going towards a cashier or for the process of checkout. Amazon-Go stores has been using “just walk in and walk out” technology, in which the shopping marts combine ceiling cameras, computer vision, Artificial-intelligence, machine learning and weight sensors.
Limitations: Estimated hardware like this would costs around $1-1.5 million and it would take more innovative ways to cut cost for the budget of the stores around the world or around poorer countries.

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This paper [3] suggests a model with NFC or RFID tags, and the customers against the existing printed bar-code and QR code scanners for reducing long stalls or for long wait of the customers for the process of billing and making purchasing or buying items which would be frustrating and for the malls or supermarkets requiring satisfactory experience from their customers. Moreover, shopping trolleys or shopping carts equipped with NFC reader displays are suggested to maintain running total and the cost for the items bought. In this concerned path, the use of IoT systems to connect all the trolleys with the central server and providing provision of online payment would add more positivity to shopping experience for customers.

C. RFID or NFC Cloud smart cart system

Using RFID or NFC expertise for billing process of the purchased items or products which includes PCB, a Wi-Fi and a power supply to intend the shopping cart[4]. Smart trolley is estimated where it will be capable of generating bill from trolley itself by providing a centralized and automatic billing system.

D. Smart trolley with smart billing process

In this paper the authors have invented such a system which presents paper for smart shopping trolley for automated billing process using raspberry-pi and integrated billing system [5]. In this paper presentation, authors are representing system with additional functionality which will calculate the amount of products in the trolley and update the product information to customers display screens with cost and other information’s, when the customers or consumers purchase products from store or shopping marts. Also, when the shopping process is done the consumers have to press a key when their shopping process is done then the billing counter displays the number of items in the trolley and the particular items inside the trolley on the LCD screen and then the consumers have to finish their billing process near the counter. The new billing process will generate only if the customer detached some creation from their shopping trolley[6].

Drawbacks: It is difficult to stick an RFID tag or NFC tags to some products. Here like ZIGBEE is used to launch the communication between trolleys and the billing counter, so the ZIGBEE is having a distance barrier.

E. Automated billing for smart shopping using IoT.

This paper has proposed a smart trolley system uses raspberry pi for wireless communication between the customer and the data servers. Every last trolley is joined with a reader per user and the data about the trolleys are kept in the data servers. The context work and the idea at which the customers buys products and the consumer or customer must inspecting the products. Raspberry pi which is present in the trolley will get the details of the products from the database and it shows the product information to the customers on LCD which is present. The LCD will show recent product details along with the total cost of the products which is present in the shopping trolley. This will help the customer to not to cross over the budget of their choice. As soon as the customers moves towards the counter the data base will send notification for the process of billing to the counter’s database to start the process of billing.

III. CHALLENGES OF THE PRESENT SYSTEM

- Consumers must wait in a long row and spend more time for transaction purpose even for smallest of items or products.
- Consumers used to estimate the total cost to be paid manually to fix their products as per their budgets near the counters.
- Barcode scanners need a direct line of vision to scan the products to be capable of reading and continue the billing process.
- In supermarkets or shopping marts to read the barcode, the barcode scanner needs to be rather near or close to the products barcode about no more than 3-4ft.
- Barcodes does not have all any read or write options and the database do not consist of any extra particular information about running or out of dates or expiry date products information etc.
- In the present systems the bar codes are used for skimming the item information where the consumers are likely to wait in a long line and spend more time for the billing process which is monitored by expenditure and manufacturing dates.
- Every single items in the marts must be physically checked for the bar codes and for the product information.

IV. PROPOSED METHODOLOGY

The key objective of the proposed systems is to deliver expertise cum concerned information of the products
with low-cost, easily accessible, and an even a system for supporting shopping processing as well as for the billing process. The raspberry-pi power driven electronic shopping store is built to improve the complete shopping process for customers as well as consumers. Once the customer enters the store, the person would register themselves in the store to the database, the person would be getting raspberry-pi basket from the store for his further shopping process. The details which is present during the registration process would include his or her name, billing address, contact information, e-mail id, general identity information like identity proof etc as well as transaction details like bank account number, credit, or debit card details. Once the registration is complete, the person can enter the store or shopping complex and start their shopping process. This shopping system is also observable to the customers or consumers people who have not yet registered and who are generally called window shoppers. After the customer or consumers enters the store, the person can look take the products in which the person wants to purchase, after this the database identifies the product information, the person would need to verify his or her identity via scanner. When the customer or consumers scans their products with the camera which is already present inside the raspberry-pi setup in the shopping basket or shopping trolley, it sends the information like product details and content information to the database through Raspberry Pi via serial communication drivers, this raspberry pi will get all the necessary details of the products from the database and then onto the display which is present on the basket. When an authorized card is scanned, the lock on the rack will open and the customer is eligible to take the products. He would need to show the taken product before the camera and the details would go to the database via raspberry pi which is connected to the raspberry-pi and camera. Once the customer confirms his bill, he can verify the details of the products and go through transaction process and pay the necessary bill online and just walk out of the store. In this way, the customer has a quick and easy shopping experience in shopping store.

Functional Flow Chat

Technology Used in the Proposed System

A. Image processing

To identify objects, the authors have used image processing in this project and with the help of image processing and machine learning, the products details will easily be recognized and the camera present in the raspberry pi will scan the product which is presented in front of the camera and the raspberry pi will be able to recognize the product easily through the data base information of the product which is already present in the database of the shopping complex or shopping mart. One of the major distinguish-er in image processing is the cascading classifier which is present in Open CV. The Object detection using this image processing and machine learning feature which is based on cascading classification which is an effective object detection process which is proposed by Paul Viola and Michael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. This is a machine-learning based approach where a cascading function is trained from a lot of positive and negative images which is present in the data base, this is then used to detect objects in other images to finalize the product. Initially, the algorithm needs a lot of positive images and negative images
to train the classifier of the Open CV functions. Then the raspberry-pi needs to extract some features from it, at each stage of the classification label the region is defined by current location of the sliding window as either positive or negative products is determined by the Open CV function. Positive indicates the object or product was found and negative indicates no object or product was found. If the label is negative and classification of this region is complete, and the detector slides which is present in the sliding window to the next location on the data base. If the labels are positive, the classifier passes the region on to the next process. This detector reports the object is found. The stages are designed to reject negative samples as fast as possible, and the assumptions is most windows do not contain the object which is interested.[8] true positives image detection of the products are rare and it worth taking the time to verify and consolidated the data base with high definition images[9]. A true positive product hit occurs when a positive sample is correctly classified using image detection and a false positive hit occurs when a negative sample is mistakenly classified as positive and shows the product is taken, this false negative occurs when a positive sample is mistakenly classified as negative hit when the product is already taken or bought. This Object identification or object detection is the most crucial part of the proposed system as it deals with the products the consumer is buying for the billing process.

B. Payment Gateways for the payment process

For implementing the automatic billing process there needs to be a platform for online payments. Hence following are the common payment gateway providers for the billing process:
- CCAvenue (Frequently used)
- PayU
- EBS by Ingenico
- Directpay

PCI-DSS (Payment Card Industry Data Security Standard), the gateway providers provides the necessary security requirements and reduce the risk of losing the data from credit and debit cards or any other information. They suggest how data breach could be prevented, detected and how one must react when data breach occurs. PCI-DSS is used by Visa, MasterCard and American Express cards. The updated version of PCI-DSS is V.3.2 from February 1, 2018.

V. ADVANTAGES OF THE PROPOSED SYSTEM

- Fully automated system even the transaction process.
- 2 factor authentication or 2 step verification of the user takes place.
- Customer’s time is saved as there is no check out system for the billing process.
- It also reduces the human supervision for the billing process.
- Transaction details are available online and can be accessed anytime and anywhere during the billing process.
- The proposed systems are Cost effective solution for limited budget stores.

VI. REQUIREMENTS

A. Hardware Requirements
- Web camera.
- Raspberry pi Device.
- Pi camera.
- Shopping cart or shopping trolley

B. Software Requirements
- Python programming language will be used for Raspberry pi configuration.
- HTML Language for designing the website.
- PHP Language to maintain the database.

C. Database Required SQLITE
- XAMPP SERVER for maintaining the communication between the website and the raspberry pi database

VII. RESULTS & DISCUSSIONS

The raspberry pi has more advantage than the standardized RFID tag or NFC tag which gets tampered because of temperature, water, physical tear and other causes. This guarantees the product information is stored safely and the communication gateway in shopping trolleys or shopping cart does not open until an item or product is scanned and its information is read properly by the raspberry pi camera. The information of items put inside the trolley helps in making sure the robbery of items or products and removing of the items or products which
are not charged more for the customers. Removing an item or product can likewise be done by same procedure, and the device (raspberry-pi database) stores the information into the local database server which is already created for the raspberry-pi. The result shows the working model is executable in current shopping situations.

![Figure 1: Counter Login Interface](image1.png)

![Figure 2: Billing process Output](image2.png)

VIII. CONCLUSIONS

As shown by customers perspective of the project has modified the method for buying or shopping for an product, and obviously the raspberry-pi has major advantage over scanner tags like RFID or NFC by its precision and quick reaction using artificial intelligence and machine learning process, along the features which is present inside the where it also permits better shopping knowledge utilizing and better shopping process to improve and innovate the design which can be taken care by any regular person who just is knowledgeable to purchase products. Future scope is to utilize improved raspberry-pi as per product which works in high accuracy ratio with which the consumers can assume the labels which are present on the products at the same time, and also stock monitoring can be consolidated and utilize IOT which thus helps in mechanization and automation of the stock administration and updating the information of the products. From literature survey’s and clarifying about the various shopping systems all over the world, the authors concludes the system is reliable and the proposed model is cost effective as compared to the highly technical amazon-go store or their shopping carts or shopping trolleys.

IX. REFERENCES


