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Automatic Billing Shopping Cart

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Abstract

Shopping malls plays a major part in ones lives. People living in the outskirts of the city often go for shopping to purchase their daily requirements. Shopping can be tiring but is an unavoidable activity and we would like to enhance this experience. At shopping malls people buy several items and wait at the cashiers to get billed,the cashier prepares the bill using the bar code reader which is quite a long process, which is exhausting. Also at times customers are out of money which they realize once at the counter thus leading to embarrassing situations. In this paper, we are putting together a brilliant shopping framework utilizing object detection algorithm and Raspberry Pi controller. The main objective of this is to minimize the time spent waiting in queues and that is what the automatic billing shopping cart does. It identifies the items using machine learning techniques and updates the required information into the customers' account which can be accessed using their phones, where they can view their bill. YOLO model is used for object detection. The customer pays the bill at counter and leaves.

Keywords*- smart shopping cart, object detection, machine learning, YOLO*

1. INTRODUCTION

INDIA is one among the largest marketing center in the world. The manufacturing and consumption in India has increased considerably since the past few decades, hence it is vital that we provide clients with the best experience. When it comes to shopping, people find it quite difficult and exhausting to locate the products they wish to purchase. Long and crowded billing counters make shopping a lingering task.

With the advancement in technology, mobile devices are not just for sending a message or making calls. They have become our communication tool, entertainment gateway, our wallet and the doorway to real-time information designed for our needs. This was possible only through the development in android which resulted in several inventions in the mobile world that gave birth to the powerful mobile devices that we use today. Around 460 million people use mobile phones in India of which 250 million are smart phone users. This has led India in becoming a bigger producer than the U.S and is only second to China.

As a matter-of-fact, markets these days are exploited by a significant amount of individuals in order for securing most of the items. Clients usually encounter some problems and difficulty during purchasing like worrying if the money which they have brought would be sufficient for all the items purchased. Not knowing about daily offers, can cost them additional money and consume more time. Waiting in long queues at the cashier is also an issue faced by the customers. A major shortcoming of the existing shopping systems is the use of barcode scanning where communication is based on the line of sight propaganda.
With our efficient billing system using machine learning, customers won't have to stand in billing queues for long hours. This system shall not only eliminate the long queues in supermarkets and malls but also save a lot of time for the customers.

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The detailed description about the paper is given below. Section 1 is about the related work, Section 2 explains about the proposed work, Section 3 gives the methodology, Section 4 shows the result and discussions with the previous work and the last section gives a conclusion about the paper

2. RELATED WORK

[1] **Praveen Kumar B O, Dr. Suryaprasad J, Roopa D Arjun A K, "Low-Cost Intelligent Shopping Cart"**

discusses an innovative concept of RFID based smart shopping and billing. The basic idea here was to aid a customer in everyday shopping in order to decrease the time spent while purchasing a product. The purpose was to offer a technology based economical, easily scalable, and strong system for assistance in shopping.

[2] **Chandrasekar, P., &Sangeetha, T. , "RFID Based Automatic Billing Trolley"**

In this technology communication is in between the tag and reader. The tag is a movable object like a smart card or any type of mobile object. Each tag has a magnetic strip with a specific code and that is read by the RFID reader module. The billing system is based on Radio Frequency Identification (RFID).It provides an appropriate solution to the physical billing routine in shopping malls. The objective of this paper is to provide an able technology for the billing process in shops.

[3] **Thakur Prerana ,ShikhaRanjan, Prachi Kaushik , "Smart Trolley And Automatic Billing"**

It consists of the following -RFID reader, motion detecting sensor, liquid crystal display (LCD), push buttons, switches and Zigbee. So if the user wishes to use the smart cart facilities then they have to press the start button. As the customer puts some product into the trolley, its tag is read using the RFID reader and the price of that item will be appended to the shopping list and the sensor senses the way of motion of the item for fault detection and the buzzer will go on if a error is sensed. When the user wants to take away any product then the user should press the remove button and the item code will be read by RFID reader and in case of any fault detection the buzzer will go on. At last, the counter with minimum customers will be identified and shown on the cart LCD screen. And then, the final bill will be transferred to the counter having least waiting list using zigbee .

[4] **Udita Gangwal, Sanchita Roy, Jyotsna Bapat , "IoT Applications on secure smart shopping system"**

It uses ECC-based cryptosystems. Here they thought about privacy and security issues associated to smart shopping systems as no prior research has attempted it. In this system, wireless communications along with the server and items are susceptible to various attacks; an adversary is able to interfere with the communications if no suitable security method is applied.

[5] **Rajithkumar, B. K., Deepak , "Design and Development of Weight Sensors Based Smart Shopping Cart and Rack System for Shopping Malls"**

The objective of this system is to provide an economic, technology oriented, and easily accessible system for assisting the shopper in shopping. It reduces the time consumed and the load on the customer throughout the billing procedure. Maintenance cost of the shop can be decreased by realizing this conception of automatic billing shopping cart. In order to work more smoothly and efficiently more features have been included. The system can effortlessly detect any change in the weight that is more than 1 gram with the accuracy of 98.98% .

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[6] **Dylan Hicks, Kevin Mannix, Hannah M. Bowles, Byron J. Gao, "Smart Mart: IoT-based In-store mapping for mobile devices"**

In this paper, a feasibility study that exploits the Internet of Things (IoT) technology to make shop items smart is presented so they can be automatically registered and its location information is updated in an information retrieval system, letting customers to trace, map and search for them on the store floor plan using their mobile. Free and accessible Android-based mobile applications Smart Cart have been developed to exhibit this preliminary effort. Constant development of this research can lead to a whole lot of changes in our day-to-day shopping experience.

3. PROPOSED WORK

This paper gives a clear solution for the problem of waiting in long queues and eliminates the existing limitations in shopping.

This creates a better shopping experience for the customers. It completely eliminates the man-power required at the cash counters and the counters itself. This cart contains a camera to verify the products using advanced object recognition system. This avoids the problem of damaged barcodes and the exercise of a barcode system.

The proposed system includes a web interface that guides the customers throughout their shopping.When the customer starts their shopping, they must first login to their account. The cart is then connected to the server that contains the database once the customer logins his/her account. The database stores all the information related to the product purchased by them. The users previous shopping history can also be accessed. Once the customer is done with their shopping, the bill is produced and is displayed. A detailed study of Fig 1 –Block Diagram is given below.

Basic Operations:

1. Account Login:

A web based application have been developed to exhibit the preliminary work. The web application is made on Django which is written in python.Each user can login to his/her account before they start shopping. Their previous shopping history can also be viewed here.

2. Object Classification:

The products are classified using yolov3 model in order to help the customer bill their products using image processing.

3. Bill Generation:

It recognizes the product placed in front of the camera module and correspondingly displays the price of the item in the web interface. The database which contains the information of all the products that are present in the store, resides on a server. Once the shopping is over, the bill is generated. For simplicity MySql database is being used. It consists of two main tables, one for storing details of products and other for storing customer details.

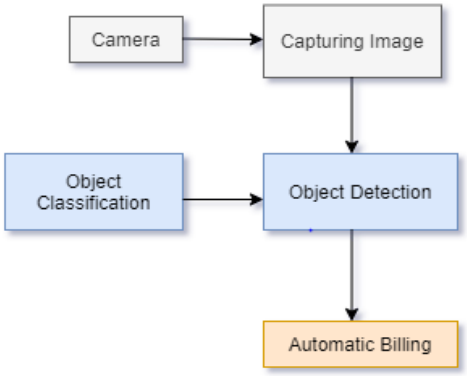

Fig 1: Block Diagram

The hardware requirements are:

A. Raspberry Pi 3B Model

The Raspberry Pi [4] is a mini single-board computer. Single-board processors do not have enough computing power compared to the traditional desktop systems but due to their size and being inexpensive they are more desirable to use for certain tasks. It is very useful for both business and personal use. The Raspberry Pi 3 model B includes a 1.5GHz 64 quad-core ARM cortex-A72 processor, with 512KB shared L2 cache.

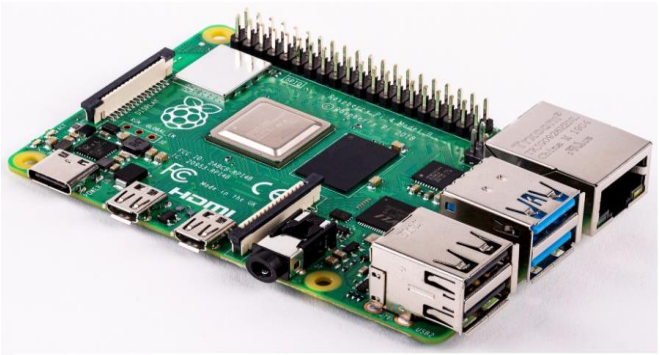

Fig 2: Raspberry Pi 3B Model

B. Load Cell

A load cell is a transducer (a force transducer). It converts the force such as compression, tension, pressure into an electrical signal which is determined and kept consistent. When the load cell increases as the force is applied, the electrical signal varies accordingly. Here, load cell is used to check the weight of the items like fruits and vegetables which is bought in bulk quantity. So the price corresponding to the weights are generated.

4. METHODOLOGY

Real-time object detection requires a lot of processing power and on a system with limited performance, achieving a speed that can be considered as real-time is a demanding task. There are several techniques that can be chosen to detect objects. Two popular techniques are called SSD [7], YOLO [8]. Here we use YoloV3 object detection algorithm. Here, the network partitions the image into many regions and calculates bounding boxes and feasibility for each region. The bounding boxes are weighted according to the predicted possibilities. Fig 6 shows the bounding boxes around the detected objects in the image and Fig 5 is the output of the model which prints the confidences of all the objects detected.

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These techniques are applied on a Raspberry Pi to check if they are suitable to run on such low performance hardware. An object detector is said to be suitable if it attains high accuracy and required frame rate to be used in practical applications. The assessment is done by performing few tests on each detector and analyze how they perform in detecting frame rate,accuracy and inference time.
With house security as an application area in mind, a person is chosen as the object to be detected in the accuracy test.

This Automated shopping trolley records all scanned products of the particular trolley with allotment number and is linked with the supermarkets' backend database which contains information regarding the products such as available stock, cost price, location and quantity of the product.The object is detected with the help of the camera and processed using Raspberry Pi. Once the object is detected, it displays the cost of the item in the web interface and the total price of all the items is added to the bill. The automatic billing shopping cart system is also connected to various devices such as load cell, switch module.

The web based application is made on Django. Django is a high-level web framework which is written in python as shown in Fig 3. It does not need any particular tools or libraries or any external libraries. The framework is light and the risk for Django security bugs is also very less. It has a direct path for accessing the SQL.Here, we have installed Django in Anaconda environment.

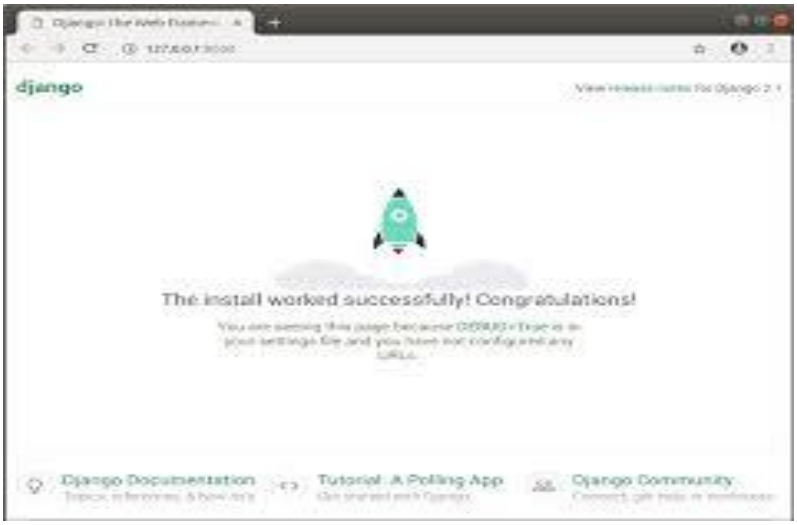

Fig 3: Environmental setup for Django

The Yolo model identifies 80 different objects in images and videos. Fig 4 is an example of the GUI, this is the user login page. Once the user enters their account credentials, they can login to their account and start purchasing.

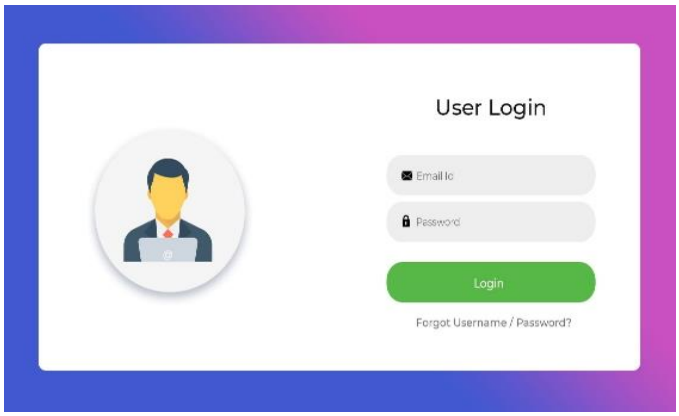

Fig 4: Login to User Account

5. RESULT AND DISCUSSIONS

```
C:\Users\USER\Anaconda3\python.exe C:/Users/USER/PycharmProjects/cart/yolov3.py --image apples.jpg
0.9300989508628845
47
apple:0.93
bowl:0.90
apple:0.88
apple:0.74
apple:0.70
apple:0.54
Done processing !!!
Output file is stored as  apples_yolo_out_py.jpg

Process finished with exit code 0
```

Fig 5: Output

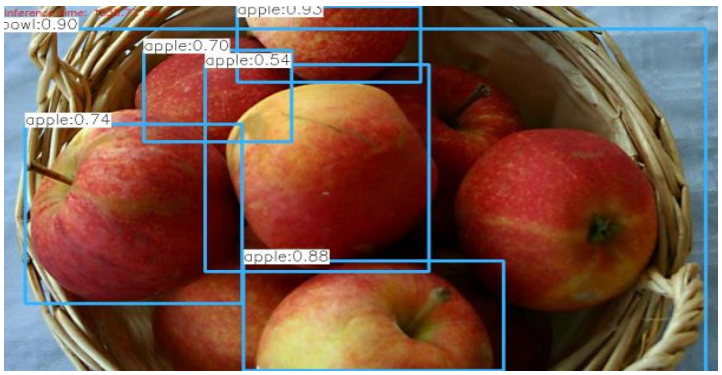

Fig 6: Object detection

In this paper as the name suggests, the billing technique is improvised. It is less time consuming as compared to regular billing technique. It is more reliable and provides ease for shopping. The proposed work is a time saving process. This system reduces required number of salesman at the counter.

The proposed system includes a web interface that guides the customers throughout their shopping. When the customer starts their shopping, they must first login to their account. The cart is then connected to the

server that contains the database once the customer logins his/her account. The database stores all the information related to the product purchased by them. The users previous shopping history can also be accessed. Once the customer is done with their shopping, the bill is generated and is displayed.

Table1 is a comparison between the previous work (using Barcode) and the proposed work:

Properties	Previous Work (Barcode)	Proposed Work
Read Rate	Low throughput. Only one tag can be read at a time	High throughput
Line of Sight	Required	Not required
Durability	Low. Is easily damaged , cannot read if destroyed	High durability.
Read and Write Capability	It has ability to read items and nothing else	It has ability to read, modify, write, update

Table 1: Comparison between previous work and proposed work

6. CONCLUSION

The Smart Cart is not only effective in eliminating the long queues but also handles the budget of the customer. This system is programmed and far better than the current barcode system. The barcode reader method is lingering and hence requires to be enhanced. As new technologies are rapidly making every day of our lives smart, shopping should be made smarter too. This system has a very quick and easy billing option.

In this paper, we have proposed an idea of an automatic shopping cart which includes a Web based application, Raspberry Pi and a load cell. The customer can login to his account using account credentials and start their shopping. Each product taken by the customer is detected using Machine Learning Techniques and the corresponding price is displayed in web interface. The database contains the information of all the products present in the store. The final result is the Bill which is generated at the end of the shopping.

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