Smart Supermarket Billing System Using Python

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Abstract-

In today's era unstaffed retail stores have become more popular in recent years and they have had a huge impact on traditional shopping habits. Unmanned retail containers play an important role in this area they can have a significant impact on the consumer shopping experience, while conventional methods based on weighing sensors are unable to detect what the customer is taking. This paper proposes a smart unstaffed retail shop scheme based on image processing, with the goal of determining if the unstaffed retail shopping style can be implemented. An end-to-end classification model trained by the method is developed for Stock Keeping Unit (SKU) counting and recognition based on a data set of images in different scenarios containing different types of SKU and the proposed solution in this study is able to achieve counting accuracy and recognition accuracy on the test dataset, indicating that the system is efficient.

Keywords:-cashless economy, security, distributed database, visual cryptography, etc.

I.INTRODUCTION

To automate the billing system in supermarkets there will be several predefined shapes in the database. The camera will capture the image of goods, it will find the objects which are predefined then it compare with the database, the software part will calculate the amount of bill. Many grocery supermarkets, such as Big Bazar use barcodes for billing and statement generation. In such shops, LASER bar-code readers are used at check-out counters, but the distance between the sensor and the object should be close to zero when the reader is applied. Either the reader or the items must be manipulated by the billing staff. Each item must be scanned individually, which takes a long time. In several cases, the barcode is either broken or there is also downside in reading barcode because of lighting effects, low resolution etc. A bar code based billing system is also expensive as it requires bar coding of all products. High-speed computers with excellent processors and storage space have resulted from technological advances. Robotics and 3D Object Recognition concepts can be used to create a real-time automated billing program that will make laborious human work easier. The human operator must be excluded from the process in order to automate it. Computer vision-based systems may be built and implemented for automated billing applications that require minimal human intervention and have shorter wait times, resulting in increased customer satisfaction.

Local descriptors are commonly used in real-world applications such as image retrieval and object recognition. While using local descriptors, there are two things to keep in mind. First, the interest point must be selected in terms of location and scale in order to protect only those points that are most likely to stay stable through transformations. Second, the interest point descriptor should be distinct, succinct, and transformation invariant. The computation of local interest points, computation of descriptors, and indexing/matching are the key steps in object recognition. During the feature some operators are used in the detection stage to identify typical key points that match well in other images. During the feature definition level, the detected features are given a name based on the pixels that surround them. During the matching stage, each requested feature is matched to features that are identical to the referred one. Different types of local feature detectors and descriptors have been developed, but using various descriptors interest point algorithms for detection, definition, and matching yields different recognition rates, performance, computation times, and memory requirements. The task at hand is to identify algorithms that are appropriate for an automated billing program, as well as to strike a balance between different parameters to better fit the application. Corner detectors detect the intersection of two or more edges, which is known as a corner.

II.LITERATURE REVIEW

Gorbunov V et al., proposed the detection and classification of fabric defects based on digital image processing. It provides the higher speed and accuracy of defect detection than human vision and to search the source of the defects. At first it will find the size and position of wefts or warps of fabrics from an image. Then calculate the pattern of weft and warp positions and calculate whether there is a defect or not. Open CV library and python programming language are used for the experiment. Seven kinds of defects on the fabrics model images are detected and five real fabric images are used for the experiment. Using Open CV and python we get the result of successful defect detection with 95% rate, and it is 50% faster than human vision in fabrics density calculation. The type of pattern should be same if different then it can give less accuracy for defect identification [1].

Sarvini T et al., proposed the conventional methods of weed removal are time-consuming and require more manual work. Hence there is a need to automate this process. The objective of the proposed system is to detect weed from crop using machine learning algorithms. The exhaustive dataset is collected for four different commercial crops and two types of weeds such as Para grass and Nutsedge. The shape features of an image are extracted to provide distinguish properties between weed and crop. The classification of weed and crop has experimented with three different classifiers: Support Vector Machine, Artificial Neural Network and Convolutional Neural Network. The performance comparison of weed detection algorithms is executed on the Open CV and Keras platform using python language [2].

Lizheng L et al., proposed unstaffed retail shop has been emerging in the past few years and significantly affected conventional shopping styles. In this field unmanned retail container plays an important role, it can highly influence the user shopping experience, the traditional method on weighing sensors cannot sense what the customer is taking. This paper proposes a smart unstaffed retail shop scheme based on image processing & open CV python which aiming at exploring the feasibility of implementing the unstaffed retail shopping style. Information regarding Automatic segmentation & counting of fruits using image processing and open CV python. The merits of this paper are that it use open CV python which

gives more than 98% accuracy & It is better than manual counting while the demerits are un employability will be increased because one machine can do work of many persons [3].

Mohammed A et al., proposed sensible Cart provides a centralized and automatic charge system mistreatment RFID. Every product within the shopping precinct are going to be given an RFID tag. Every go-cart is enforced with microcontroller, LCD, Associate in Nursing RFID reader. The merchandise info is going to be browse by an RFID reader and it's displayed in liquid crystal display that is interfaced to the controller. In the charge cabin, the whole bill is going to be transferred to a laptop by Bluetooth module [4].

Ashok S et al., proposed it consists of RFID tag, LCD display, android application, Wi-Fi and cloud. All products present in the shopping mall will be tagged with RFID. Customer's required products will be put in the trolley, where its code will be detected using RFID and name of the product and cost will be displayed on the LCD. Data is pushed to the amazon cloud using Wi-Fi module ESP8266 and the data is sent to Android App of the Customers. Total billing is done by wireless modules [5].
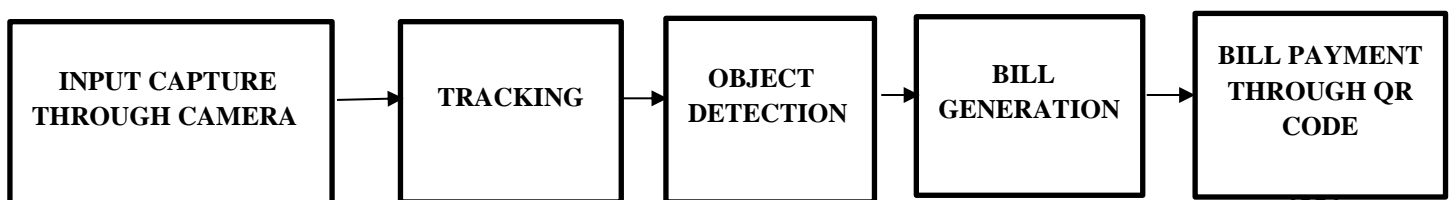
Berdaliyer Y, et al., proposed developing the electronic smart cart device itself. It involves an embedded electronic hardware that consists of an OLED display, Arduino Mega 2560 board, a specifically designed PCB, a Wi-Fi module, 13.56 MHz HF RFID reader, a power supply and a shopping cart[6].

Sudhir Rao R et al., proposed a system based on fpga. It uses a camera which captures the video after video processing the decision is taken. But the cost of this system is comparatively higher [7].

Ou W et al., proposed technical support of mobile applications and users will be able to conduct a series of actions like product searching, pre-ordering and online payment on the mobile app. With NFC users can even pay the bills without credit card which would simplify the purchasing process. This article also proposed a corresponding management platform aiming to optimize the service and administration of the supermarket, which fits the emerging trend of O2O business mode [8].

III.SYSTEM METHODOLOGY

System is implement by using python to automate the billing process in the supermarkets. To automate the billing system in supermarkets there will be several predefined shapes in the database. The camera will capture the image of goods, it will find the objects which are predefined then it compare with the database. Input is given through the camera to the system, then input is given to tracking block. Tracking block is framed according to the need. This image is passed on to the next step that is object detection. Input from the previous operation is processed according to YOLO algorithm. In this process file like PIL, matplotlib, etc are used with the help of this file object are traced and a bounding boxes are created around the object. As per the algorithm detected objects are labelled. Thus system

| INPUT CAPTURE THROUGH CAMERA | → | TRACKING | → | OBJECT DETECTION | → | BILL GENERATION | → | BILL PAYMENT THROUGH QR CODE |

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  │              │
  │    YOLO      │
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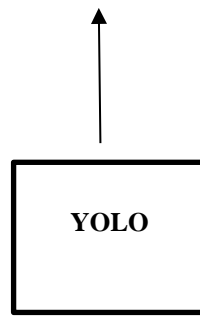
Fig.1 Block diagram of system

gets object and it is name. Similarly multiple objects are present in the frame get detected. Now according to input given by admin panel this objects are being tagged with their respective unit prices. Thus in bill generation block the total bill is estimated. After bill generation QR code is formed within which bill information is stored and this QR code is displayed on the screen. By scanning the QR code customer can pay the bill.
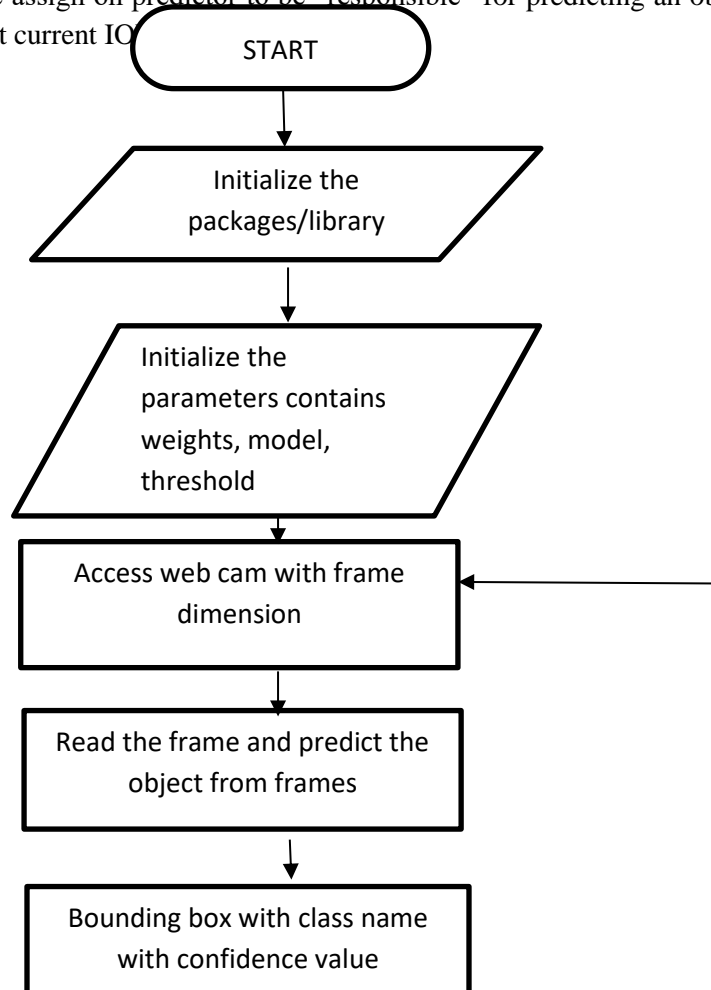
IV.EXPERIMENTATION

Admin panel add product details that are being stored in retail shop. This information is store in particular database which is further needed for object detection and its confirmation. Database contains following data of product like name, description, manufacturing date, expiry date, price discount, number of quantity. This database tells the algorithm what products are present in shop.

ID	Product Name	Description	MFG	Expire	Price	D.Price	Category	Quantity
1	bottle	Milton	5/4/2018	9/6/2021	100	95	Plastic	1
2	cell phone	Redmi	2/3/2018	5/6/2022	15000	14500	Electronic	1
3	book	Book	26/8/2010	15/7/2022	500	480	book	1
4	laptop	HP	5/6/2017	4/3/2025	60000	59000	Electronic	1
5	pen	Luxor	7/6/2018	6/8/2022	100	90	Stationary	1

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| 6 | keyboard | HP | 4/3/2017 | 2/1/2024 | 2800 | 2500 | Electronic | 1 |
| 7 | toothbrush | Oral B | 7/10/2016 | 4/12/2022 | 70 | 65 | Daily use | 1 |

Table1.Database of product details

At the beginning all the necessary libraries and packages are initialized. These libraries contain all the defined functions which are essential for image detection purpose. These packages have weights, models, parameters, threshold values of different objects. Webcam initialization is important step. Here the frame is set with required dimension. When objects are placed in front of webcam the frame is read for object detection. In YOLO algorithm the object detection is done in two stages. First, they select regions of interest in an image. Second, they classify these regions using convolutional neural networks. This solution can be slow because we have to run predictions for every selected region. We aim to predict a class of an object and the bounding box specifying object location. Each bounding box can be described using four descriptors i.e center of a bounding box (bxby),width (bw),height (bh),value **c**is corresponding to a class of an object (such as: car, traffic lights, etc.). In addition we try to get the pc value that is the probability that the bounding box contains object. We only want one bounding box predictor to be responsible for each object. We assign on predictor to be "responsible" for predicting an object based on which prediction has the highest current IO
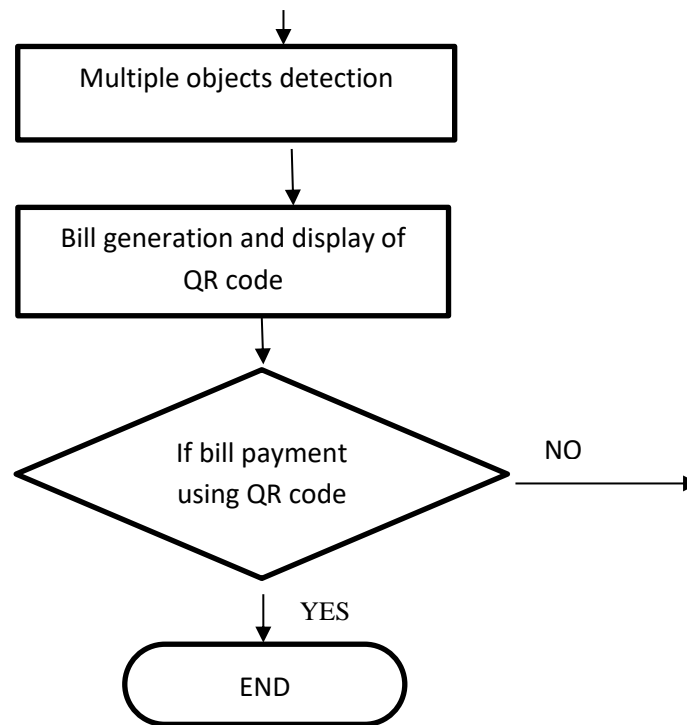
START

Initialize the packages/library

Initialize the parameters contains weights, model, threshold

Access web cam with frame dimension

Read the frame and predict the object from frames

Bounding box with class name with confidence value

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                    ┌──────────────────────────┐
                    │ Multiple objects detection│
                    └──────────────────────────┘
                                 │
                    ┌──────────────────────────┐
                    │  Bill generation and      │
                    │  display of QR code       │
                    └──────────────────────────┘
                                 │
                         ◇ If bill payment ◇─── NO ──→
                         ◇ using QR code   ◇
                                 │ YES
                            (  END  )
```
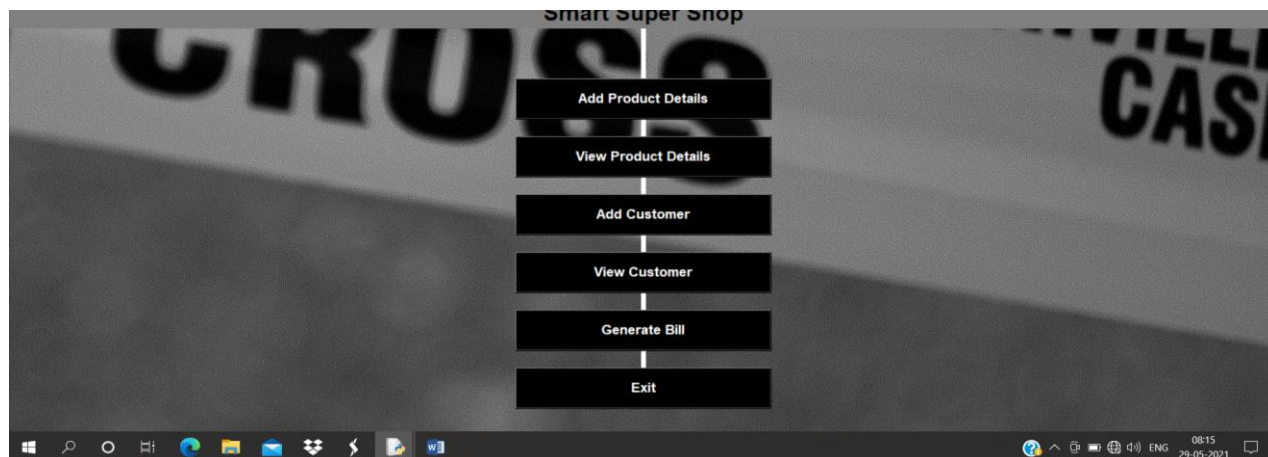
Fig.2 Flow chart

This leads to specialization between the bounding box predictors. After multiple objects detection amount tagged to respective object is assign and bill is generated. The bill is generated in such a way that QR code is formed of that bill and customer needs to scan the code to pay the bill. If bill is paid the process ends and waits for next customer and if not paid, again image detection takes place.

V.RESULT AND DISCUSSION

In the below prototype smart bill generation has been implemented using photo detection and QR code generation. Admin panel is available there for giving the product details and for adding the customer details. YOLO algorithm has been used to detect the object in frames after the detecting the object bill is getting generated. QR code is display within the whole bill is stored.

Smart Shop Model

Customer Details

Object Detection

Bill Generation

OR Code

CONCLUSION

System is implement by using python to automate the billing process in the supermarkets. This system will support Digital India. Using this system both customer and management will get a better shopping experience. In this system Open CV library of python programming language, MySQL database is used. System has implemented bill generation based on object detection. QR code has also being formed to obtain bill details on customer's device. In the future work, the focus on improving algorithm efficiency and recognition rate.

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