Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

INNOVATIVE PRODUCT DEVELOPMENT (DJ STRIKE)

SMART MART

— A Smart Shopping Experience using Computer Vision

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Introduction

- In this project, we propose a smart shopping cart system based on low-cost IoT equipment and deep learning object detection technology.
- The proposed smart cart system consists of a camera for real-time product detection, an ultrasonic sensor that acts as a trigger, a weight sensor to determine whether a product enters into or out of shopping cart, and an application of smartphone that provides a UI for a virtual shopping cart, and a deep learning server where learned product data are stored.
- The smart cart system proposed in this paper can be applied to implement unmanned stores with high cost-performance ratio.

LITERATURE SURVEY

Recently, many attempts have been made to reduce the time required for payment in various shopping environments. In many research papers, Computer Vision and Deep Learning have been used for making the shopping experience more efficient as there are many advantages of it like Reduced Time, Paper wastage, Reduced manpower etc. In the paper by Symbiosis Institute of Technology (SIT) they used infrared sensors to determine the product movement and they have also used a charging method with the help of Raspberry PI which recognizes the product and stores it in their database and makes their cart ready for online payment without the involvement of the cashier and making their experience even better. We are creating a system with more advance features with more personalized focus toward the users choice and making them stay even more in the mart and converting them into a more loyal customer.

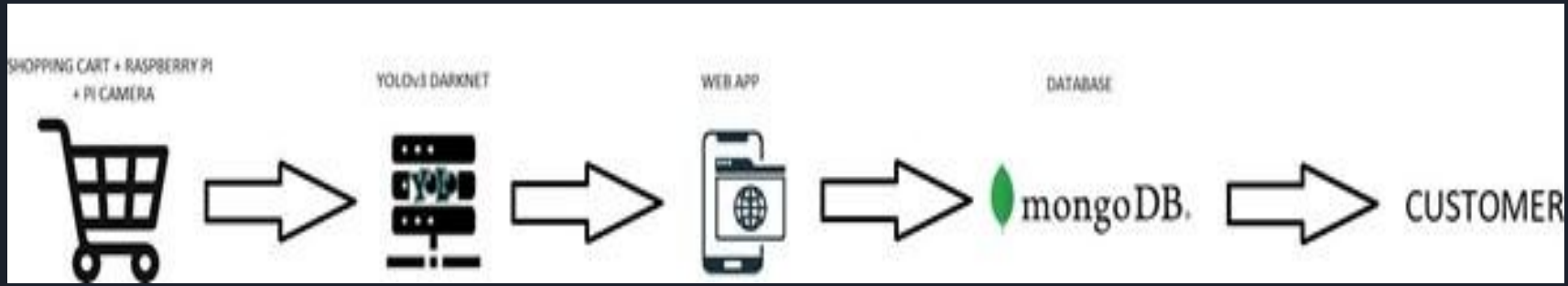
Motivation

Nowadays in Supermarkets, customers have to spend a long time in the queue to get their products billed. This causes too much discomfort, and due to which the customer may not come back to the shop that often because of which the retail owners may lose their customers. We thought how we could solve this issue and then we came up with an idea to solve these issues. We can have a self-checkout, and customized shopping experience. The customer data can be stored in a database, which would help the owner have a good customer loyalty. Retailer can serve more customers in the same amount of time

METHODOLOGY

When the user enters our mart. He/She will get a cart. There will be a 3 camera inside the cart in length breadth and the back of the cart. There will also be a tablet attached to the cart which will have our shopping site web app opened where the user can log in with their phone number/ email id and we will save their data in our database (MongoDB). If he/she is our existing customer, then they can log-in with their credential already saved in our db. After the connection is established , then our server reads the image/video from the Rpi and then uses deep learning to determine the type, the quantity, and entry/exit of the product and passes this information to the web app on user smart tablet provided in the cart. Once the shopping is completed the user will be redirected to our payment page where he/she can pay with online banking (Paytm, google pay, net banking) there will be detailed information of his/her product. Once the payment issuccessful the user will get a signed token number which will act as receipt which he/she should use to exit the mart.

SCHEMATIC / BLOCK DIAGRAM

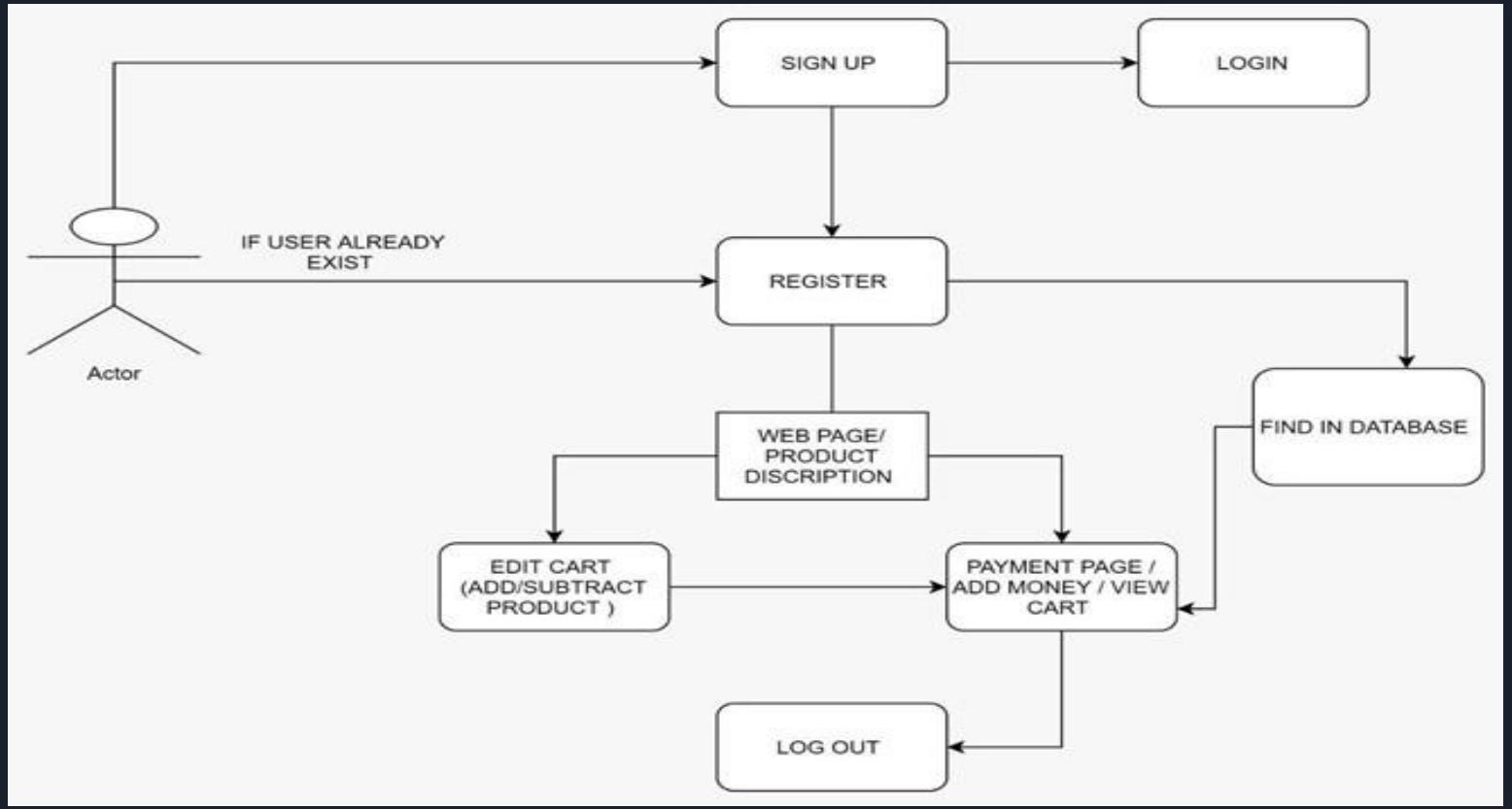


Electronics: Raspberry Pi 4, Rpi Camera, Jumper wires, Breadboard.

Development: React, MongoDB, Prime React Firebase/Aws.

AI/ML: Python, NumPy, OpenCV, TensorFlow, Keras, PyTorch, Media pipe, YOLO.

Flow Chart


SIGN UP
LOGIN
IF USER ALREADY EXIST
REGISTER
Actor
FIND IN DATABASE
WEB PAGE/ PRODUCT DISCRIPTION
EDIT CART (ADD/SUBTRACT PRODUCT)
PAYMENT PAGE / ADD MONEY / VIEW CART
LOG OUT

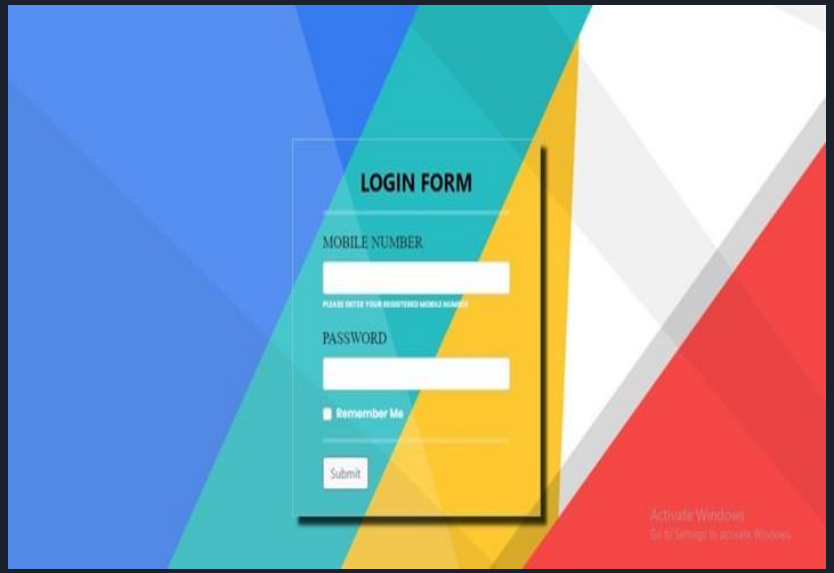
SOCIAL IMPACT

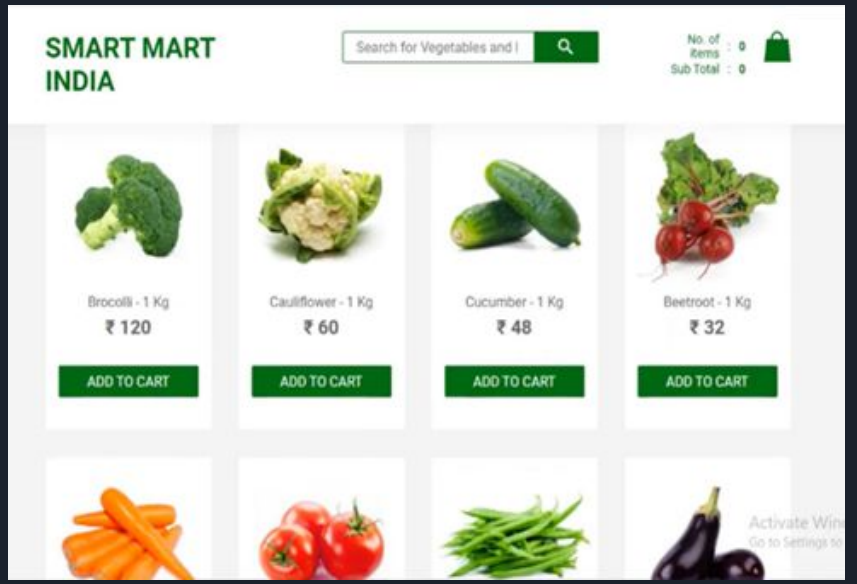
- Reduced Time: The biggest advantage of smart mart is time efficiency. It helps to reduce the queue and save time in today's fast-paced society, it goes hand in hand with busy people.
- Virtual assistant: The virtual assistance inside the mart would help the customer locate his products inside the mart, thereby reducing the time for searching his products.
- Paper wastage: Reduce paper wastage since the bill will be sent to the customer mail-id.
- Utilization of available space: With reduced use of cashier’s, the size of the shop can be reduced.
- Reduced manpower: Very few employees are required to run the shop and can be utilized for other services

Project Simulation and Progress

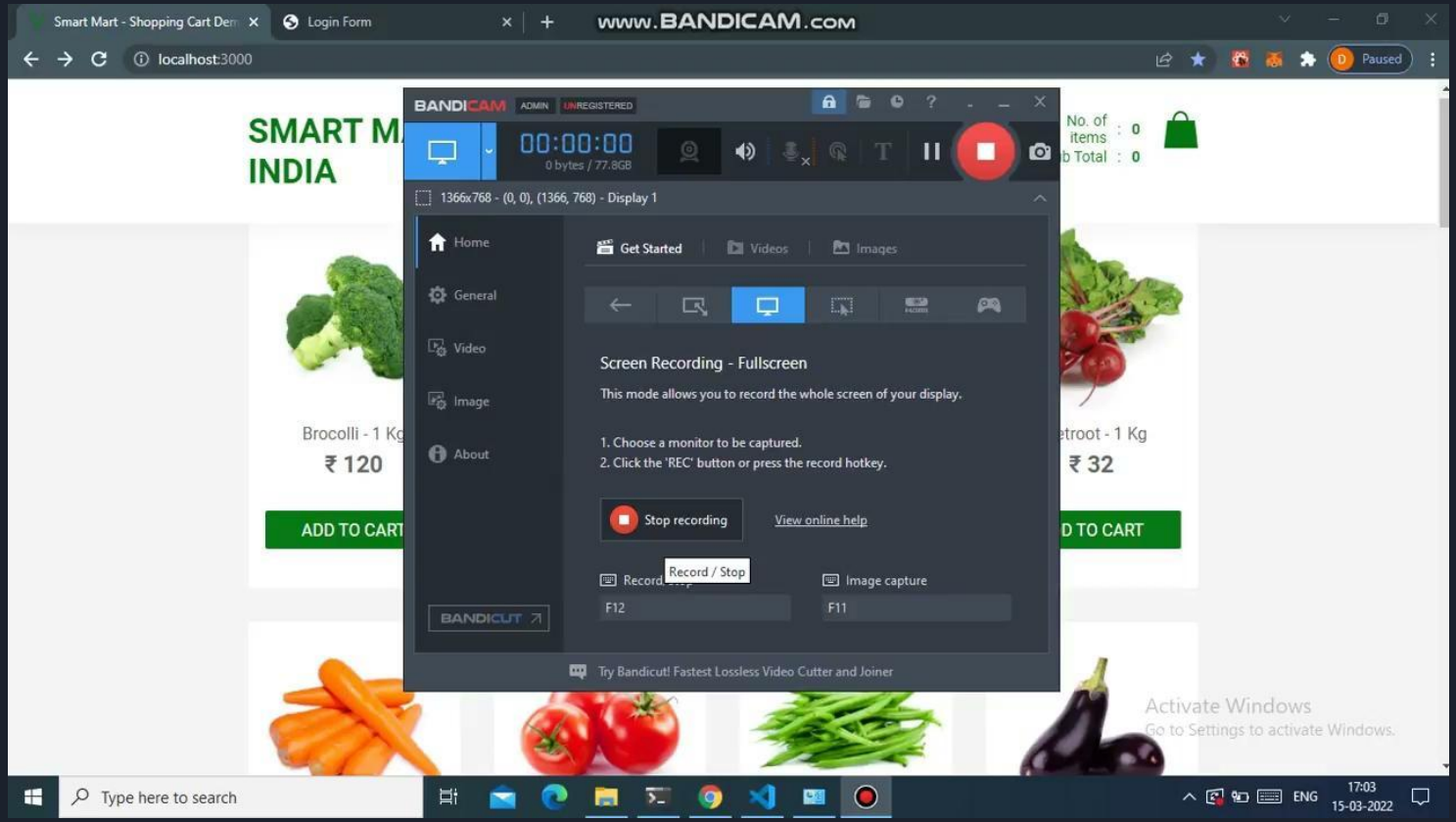
(1) Development

In development, we have created a working log-in page for our website and once we get the dataset, we will start working on Backend using MongoDB. For Front-end we will start making required web pages using the dataset we will fetch from MongoDB.



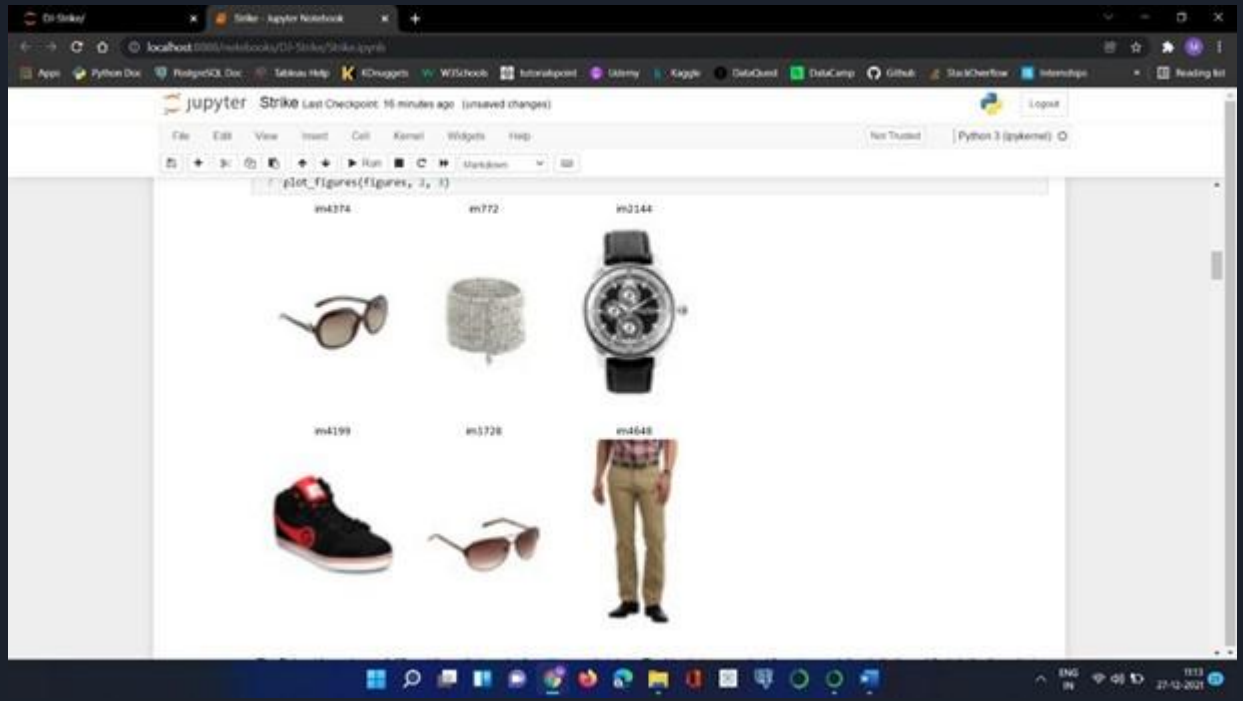


Smart Mart India Website Demo Video



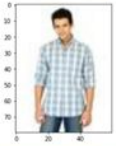
(2)Machine Learning

In Machine Learning we have created a Recommendation Model using CNN Of Myntra Fashion Dataset where basically with the help of Image Data, we recommended similar items a user would buy.



Out[19]:
```
(Int64Index([259, 4305, 0, 2779, 2701], dtype='int64'),
 [0.9040971, 0.89255124, 0.8917556, 0.88555014, 0.8812927])
```

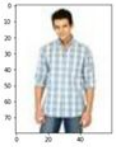
In [20]:
```
# Idx Item to Recommender
idx_ref = 2993

# Recommendations
idx_rec, idx_sim = get_recommender(idx_ref, df, top_n = 6)

# Plot
#=================
plt.imshow(cv2.cvtColor(load_image(df.iloc[idx_ref].image), cv2.COLOR_BGR2RGB))

# generation of a dictionary of (title, images)
figures = {'im'+str(i): load_image(row.image) for i, row in df.loc[idx_rec].iterrows()}
# plot of the images in a figure, with 2 rows and 3 columns
plot_figures(figures, 2, 3)
```



In [21]:
```
idx_ref = 987

# Recommendations
idx_rec, idx_sim = get_recommender(idx_ref, df, top_n = 6)

# Plot
#=================
plt.imshow(cv2.cvtColor(load_image(df.iloc[idx_ref].image), cv2.COLOR_BGR2RGB))

# generation of a dictionary of (title, images)
figures = {'im'+str(i): load_image(row.image) for i, row in df.loc[idx_rec].iterrows()}
# plot of the images in a figure, with 2 rows and 3 columns
plot_figures(figures, 2, 3)
```

im3849 im1779 im1273

```
plot_figures(figures, 2, 3)
```



im259 im4305 im0

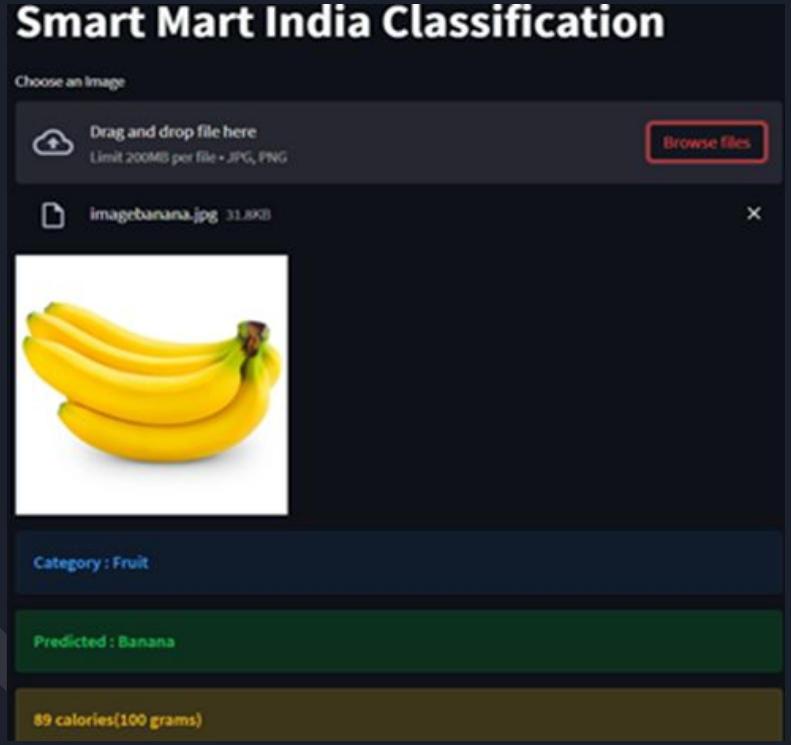
im2779 im2701 im3678

im3849 im1779 im1273

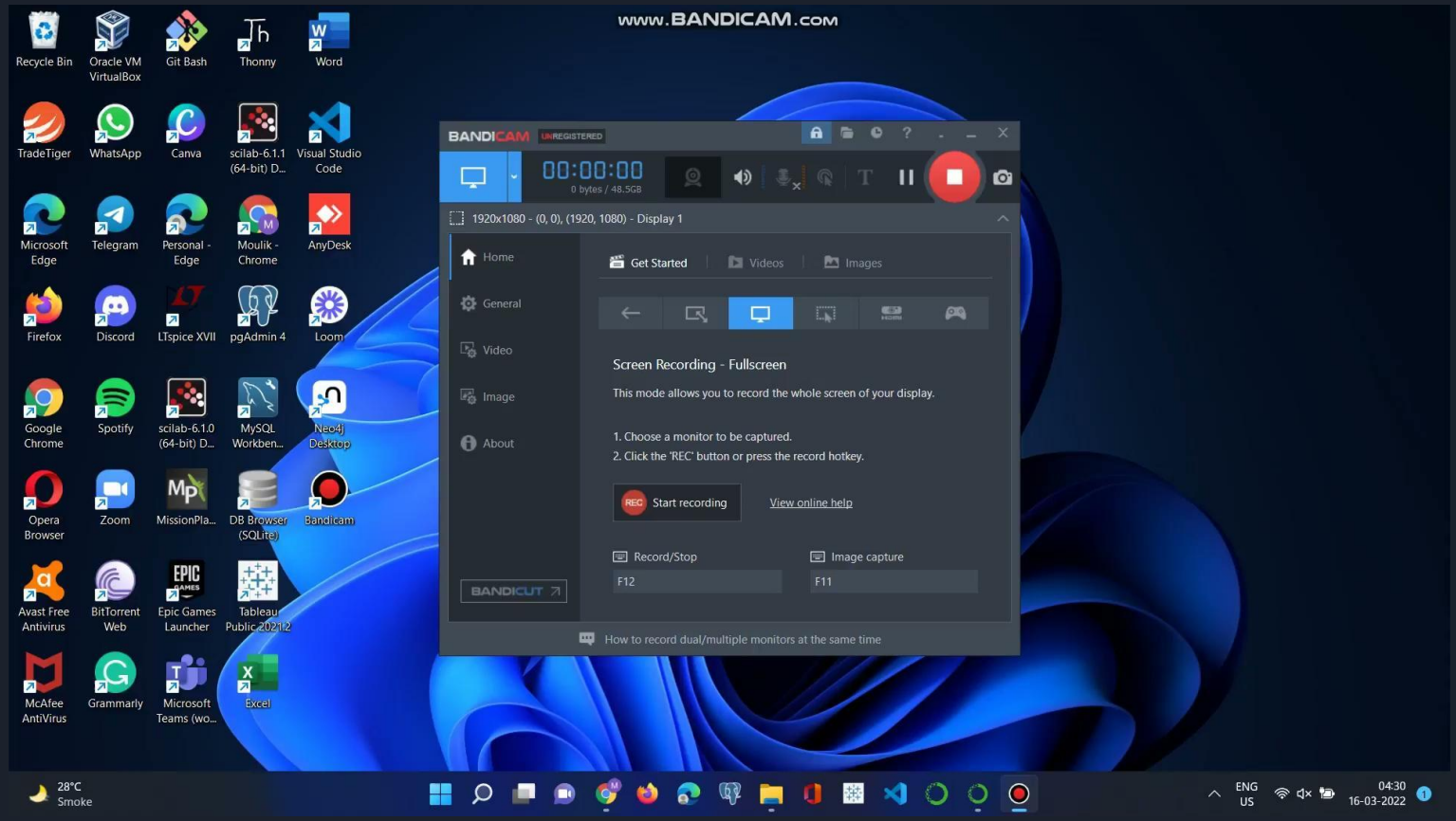
im4512 im1758 im4820

Smart Mart India Classification Photos

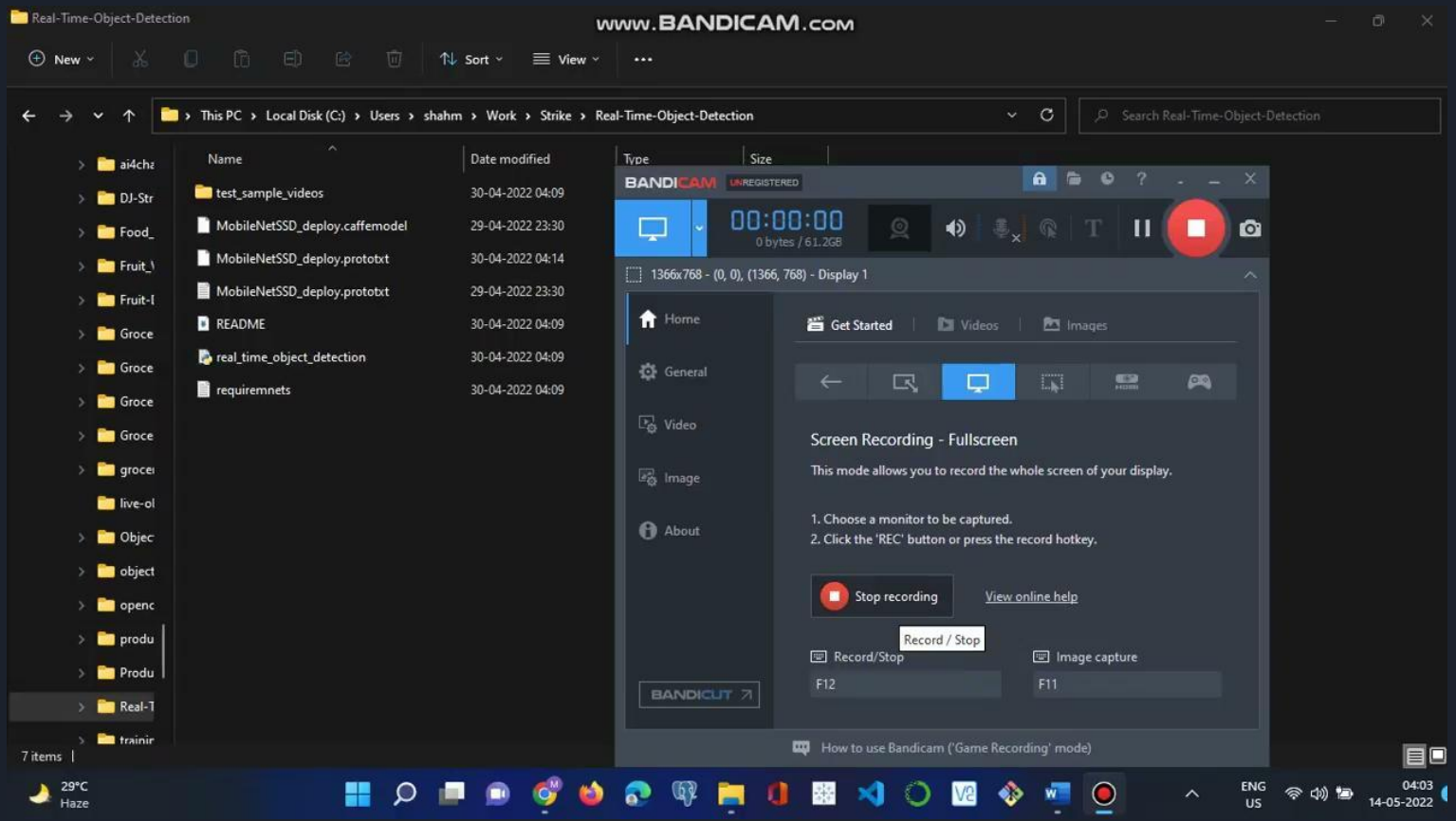
The Smart Mart India Classification Webpage is basically a dashboard which prototypes the our model for and detect the product with the calories and its category. In the Object Detection model we basically have created a model which detects specific products/items in the grocery store.



Smart Mart India Classification Demo Video



OBJECT DETECTION MODEL DEMO VIDEO



HARDWARE IMPLEMENTATION

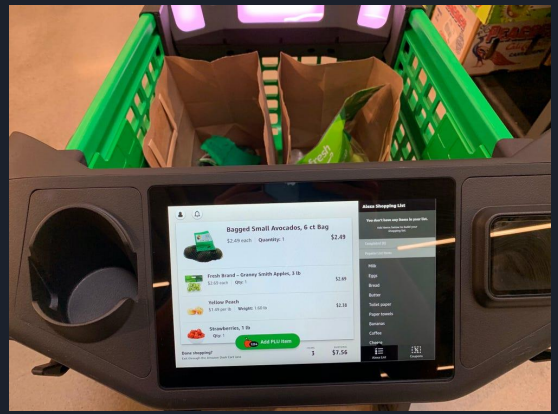
In Hardware part we have used Rasberry-pi and Rpi Cam for creating our sample smart basket. In this basket the customer/user will put the product inside the cart and the code running live on rpi would detect the specified product and through which we can update their shopping cart on website accordingly.

Conclusion

With the increasing demand for facial recognition in daily use, this is the right time to build the system. In this project, we have discussed two different algorithms which are image detection and face recognition and how they can be used together to create a new mode of payment and a system which can be used to turn the shopping marts into smart mart.There can be many more measures such as ios suitable app, in-app chatbot, admin side interface,etc which can be done to improve the quality and security of the system and make help more businesses.

Our Vision/Future goals

Our goal for the next phase of this project is to create a fully end to end working model of our project where we will be working more on development of our site and creating a user friendly interface and also improving our computer vision model to improve the accuracy in extracting visual features(produce & barcode items) for instant recognition. We are also planning to work more on recommendation so customers can search, locate and compare products while they shop and we can offer real-time recommendations based on cart content or location to increase basket size. Customers can also request assistance with a single tap.



References

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