PROJECT REPORT

ON

Food Waste Management

SUBMITTED BY:

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DECLARATION

I would like to express my special thanks of gratitude to my project guide **Ms. Ruchi Gupta** mam who gave me the golden opportunity to do this wonderful project on the topic **Food Waste Management**, which also helped me in doing a lot of research and I came to know about so many new things I am really thankful to them.

Secondly, I would also like to thank my parents and friends who helped me a lotin finalizing this project within the limited time frame.

Team Members :-

- Vedant Agrawal (201500778)
- Vijay Kaushal (201500783)
- Yash Kumar Gupta (201500820)

CERTIFICATE

This is to certify that the above statements made by the candidate are correct to the best of my/our knowledge and belief.

Project Supervisor

Mrs. Ruchi Gupta

Senior Trainer

Date: 23rd Nov 2022

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INTRODUCTION

Food waste management in India is becoming a critical problem due to the continuous increase of the Indian population. Indians waste the maximum amount of food as much as the whole of the UK consumes – a data point which will not be most indicative of our love of surfeit, because it is of our population. Most of the food is wasted in weddings, canteens, hotels, social and family functions, and households. Still, food wastage is a horrendous issue, so is food waste management in India. At a time when 811 million people go to bed hungry every night, a third of all food produced to eat is wasted or lost.

In this mini project, I and our team designed a machine learning algorithm for detecting the amount of food left by a person and analyzing the data regarding the wastage of food. For now, the result is shown in an Jupyter application as a user graphical interface.

Image Processing MatLab -

MatLab is a programming platform designed specifically for engineers and scientists to analyze and design systems and products that transform our world. The heart of MATLAB is the MATLAB language, a matrix-based language allowing the most natural expression of computational mathematics.

Classification Anaconda3 (Jupyter) -

The Jupyter Notebook application allows you to create and edit documents that display the input and output of a Python or R language script. Jupyter Notebook allows users to compile all aspects of a data project in one place making it easier to show the entire process of a project to your intended audience. Through the web-based application, users can create data

visualizations and other components of a project to share with others via the platform.

KNN (ML) –

- K-Nearest Neighbour is one of the simplest Machine Learning algorithms based on Supervised Learning technique.
- K-NN algorithm assumes the similarity between the new case/data and available cases and put the new case into the category that is most similar to the available categories.
- K-NN algorithm stores all the available data and classifies a new data point based on the similarity. This means when new data appears then it can be easily classified into a well suite category by using K- NN algorithm.

SYSTEM REQUIREMENTS

Software Requirement-

To build application –

- 64-bit Windows 8/10/11
- Java SE Development Kit 17.0.5
- MATLAB framework
- Anaconda Jupyter

To Run application –

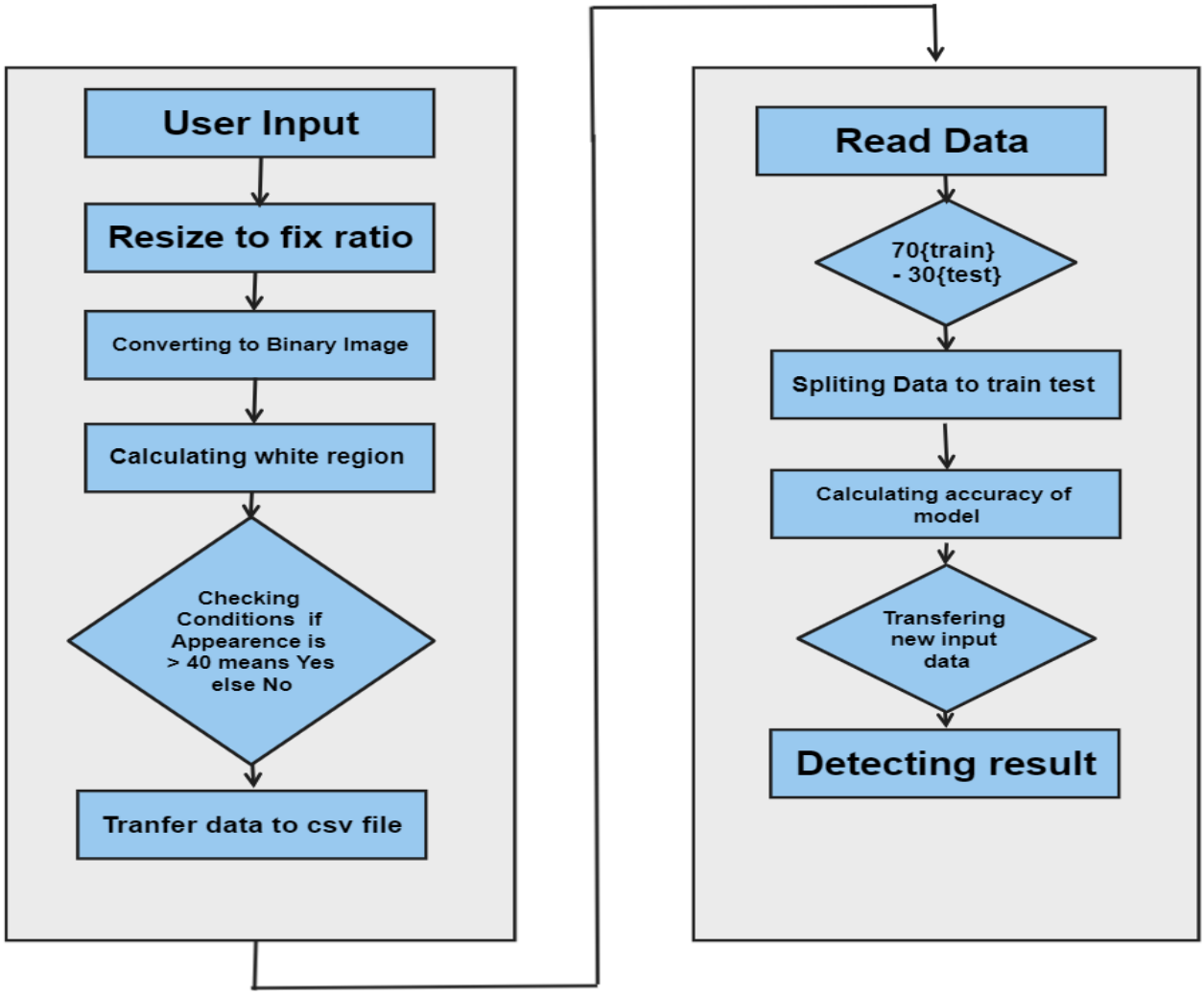
- Laptop or a system with min i3 processor and window 7 or higher versions

Hardware Requirement –

- x86_64 CPU architecture; 10th generation Intel Core or newer
- 8 GB RAM or more
- 8 GB of available disk space minimum

IMPLEMENTATION

Data Flow Diagram



Module 1 and 2 **Module 3**

Final Code –

1- Image Processing-

Framework – MATLAB R2002b

```
img1 = imread("akemy-mory-v8B1gN_QUbI-unsplash.jpg");
p1 = imresize(img1,[28,28]);
b1 = im2bw(p1);
n1Black = sum(b1(:));
```

```
n1White = numel(b1) - n1Black;
img2 = imread("alexandra-golovac-hTI5A21l0bk-unsplash.jpg");
p2 = imresize(img2,[28,28]);
b2 = im2bw(p2);
n2Black = sum(b2(:));
n2White = numel(b2) - n2Black;
img3 = imread("brooke-lark-oaz0raysASk-unsplash.jpg");
p3 = imresize(img3,[28,28]);
b3 = im2bw(p3);
n3Black = sum(b3(:));
n3White = numel(b3) - n3Black;
img4 = imread("charlesdeluvio-1KcbLiNwPhQ-unsplash.jpg");
p4 = imresize(img4,[28,28]);
b4 = im2bw(p4);
n4Black = sum(b4(:));
n4White = numel(b4) - n4Black;
img5 = imread("chris-ralston-09HGdZzkP-Q-unsplash.jpg");
p5 = imresize(img5,[28,28]);
b5 = im2bw(p5);
n5Black = sum(b5(:));
n5White = numel(b5) - n5Black;
img6 = imread("eduardo-roda-lopes-mNefYU7uRbk-unsplash.jpg");
p6 = imresize(img6,[28,28]);
b6 = im2bw(p6);
n6Black = sum(b6(:));
n6White = numel(b6) - n6Black;
img7 = imread("eiliv-aceron-0gQ8Fh1f54k-unsplash.jpg");
p7 = imresize(img7,[28,28]);
b7 = im2bw(p7);
n7Black = sum(b7(:));
n7White = numel(b7) - n7Black;
img8 = imread("eiliv-aceron-ZuIDLSz3XLg-unsplash.jpg");
p8 = imresize(img8,[28,28]);
b8 = im2bw(p8);
n8Black = sum(b8(:));
n8White = numel(b8) - n8Black;
img9 = imread("ella-olsson-n368kMQR1b0-unsplash.jpg");
p9 = imresize(img9,[28,28]);
b9 = im2bw(p9);
n9Black = sum(b9(:));
n9White = numel(b9) - n9Black;
img10 = imread("FoodWaste1.jpeg");
p10 = imresize(img10,[28,28]);
b10 = im2bw(p10);
n10Black = sum(b10(:));
n10White = numel(b10) - n10Black;
img11 = imread("plate-waste.jpg");
p11 = imresize(img11,[28,28]);
b11 = im2bw(p11);
n11Black = sum(b11(:));
n11White = numel(b11) - n11Black;
img12 = imread("FoodWaste3.jpg");
p12 = imresize(img12,[28,28]);
b12 = im2bw(p12);
n12Black = sum(b12(:));
n12White = numel(b12) - n12Black;
img13 = imread("FoodWaste4.jpg");
p13 = imresize(img13,[28,28]);
b13 = im2bw(p13);
```

```
n13Black = sum(b13(:));
n13White = numel(b13) - n13Black;
img14 = imread("henry-be-5PRQsEGkE10-unsplash.jpg");
p14 = imresize(img14,[28,28]);
b14 = im2bw(p14);
n14Black = sum(b14(:));
n14White = numel(b14) - n14Black;
img15 = imread("ira-g-3OJugRPfazM-unsplash.jpg");
p15 = imresize(img15,[28,28]);
b15 = im2bw(p15);
n15Black = sum(b15(:));
n15White = numel(b15) - n15Black;
img16 = imread("jay-wennington-N_Y88TWmGwA-unsplash.jpg");
p16 = imresize(img16,[28,28]);
b16 = im2bw(p16);
n16Black = sum(b16(:));
n16White = numel(b16) - n16Black;
img17 = imread("jenn-kosar-9Er-MNdzrPA-unsplash.jpg");
p17 = imresize(img17,[28,28]);
b17 = im2bw(p17);
n17Black = sum(b17(:));
n17White = numel(b17) - n17Black;
img18 = imread("jennifer-schmidt-MRHyv-hHxgk-unsplash.jpg");
p18 = imresize(img18,[28,28]);
b18 = im2bw(p18);
n18Black = sum(b18(:));
n18White = numel(b18) - n18Black;
img19 = imread("joseph-gonzalez-QaGDmf5tMiE-unsplash.jpg");
p19 = imresize(img19,[28,28]);
b19 = im2bw(p19);
n19Black = sum(b19(:));
n19White = numel(b19) - n19Black;
img20 = imread("joyce-LalntMdtdbc-unsplash.jpg");
p20 = imresize(img20,[28,28]);
b20 = im2bw(p20);
n20Black = sum(b20(:));
n20White = numel(b20) - n20Black;
img21 = imread("katja-grasinger-4tPjtttythY-unsplash.jpg");
p21 = imresize(img21,[28,28]);
b21 = im2bw(p21);
n21Black = sum(b21(:));
n21White = numel(b21) - n21Black;
img22 = imread("mariana-medvedeva-iNwCO9ycBlc-unsplash.jpg");
p22 = imresize(img22,[28,28]);
b22 = im2bw(p22);
n22Black = sum(b22(:));
n22White = numel(b22) - n22Black;
img23 = imread("melissa-walker-horn-vACInYhNjY0-unsplash.jpg");
p23 = imresize(img23,[28,28]);
b23 = im2bw(p23);
n23Black = sum(b23(:));
n23White = numel(b23) - n23Black;
img24 = imread("pixzolo-photography--O3wkh2jZyo-unsplash.jpg");
p24 = imresize(img24,[28,28]);
b24 = im2bw(p24);
n24Black = sum(b24(:));
n24White = numel(b24) - n24Black;
img25 = imread("sebastian-coman-photography-CRoAeTh5S_I-unsplash.jpg");
p25 = imresize(img25,[28,28]);
```

```
b25 = im2bw(p25);
n25Black = sum(b25(:));
n25White = numel(b25) - n25Black;
img26 = imread("siniz-kim-aWWl29-VX7Y-unsplash.jpg");
p26 = imresize(img26,[28,28]);
b26 = im2bw(p26);
n26Black = sum(b26(:));
n26White = numel(b26) - n26Black;
img27 = imread("food_waste_on_ground.jpg");
p27 = imresize(img27,[28,28]);
b27 = im2bw(p27);
n27Black = sum(b27(:));
n27White = numel(b27) - n27Black;
img28 = imread("Waste.jpg");
p28 = imresize(img28,[28,28]);
b28 = im2bw(p28);
n28Black = sum(b28(:));
n28White = numel(b28) - n28Black;
figure(1),subplot(2,2,1),imshow(img28),title('Original Image');
figure(1),subplot(2,2,2),imshow(p28),title('Resize Image');
figure(1),subplot(2,2,3),imshow(b28),title('BlackWhite Image');
```

2- Data Processing and Detection-

Framework – Anaconda3 Jupyter

```
#!/usr/bin/env python
# coding: utf-8
# In[1]:
import pandas as pd
import numpy as np
# In[2]:
dataset = pd.read_csv(r"C:\Users\Yash\OneDrive\Documents\FoodWasteManagement.csv")
# In[3]:
dataset
# In[4]:
ds = dataset.columns
# In[5]:
```

```
print(ds)  // refer output 1
# In[6]:
from sklearn.model_selection import train_test_split
# In[7]:
X_train, X_test, Y_train, Y_test =
train_test_split(dataset.loc[:,dataset.columns != 'Result'],
dataset['Result'],test_size = 0.30, random_state=1)
# In[8]:
from sklearn.neighbors import KNeighborsClassifier
# In[9]:
training_accuracy = []
test_accuracy = []
# In[10]:
neighbors_settings = range(1,11)
for n_neighbors in neighbors_settings:
    knn = KNeighborsClassifier(n_neighbors = n_neighbors)
    knn.fit(X_train, Y_train)
    training_accuracy.append(knn.score(X_train, Y_train))
    test_accuracy.append(knn.score(X_test,Y_test))
# In[11]:
import matplotlib.pyplot as plt
# In[12]:
plt.plot(neighbors_settings, training_accuracy, label =
"training_accuracy")
plt.plot(neighbors_settings, test_accuracy, label = "test_accuracy")
plt.ylabel("Accuracy")
plt.xlabel("N-Neighbors")
plt.legend()
```

```
plt.savefig('knn_compare_model') // refer output 2

# In[13]:

knn = KNeighborsClassifier(n_neighbors=6)

knn.fit(X_train, Y_train)

print('\nAccuracy on training set: {:.2f}'.format(knn.score(X_train, Y_train)))

print('\nAccuracy on test set: {:.2f}\n'.format(knn.score(X_test, Y_test)))

// refer output 3

# In[14]:

from sklearn.datasets import make_blobs

# In[15]:

X, Y = make_blobs(n_samples = 1000, centers = 2, n_features = 12, random_state = 2)

# In[16]:

knn.fit(X,Y)

# In[25]:

new_input = [[28,28,1130,1600,1808000,28,28,784,364,420,1.15,53.571]]

new_output = knn.predict(new_input)

print("\n'1' indicate you wasted food and '0' indicate you have not wasted food... \n")

print("User Input Datset:- ",new_input,"\n\nPredicted Result is:- ", new_output)

// refer output 4

# In[21]:

import pickle

# In[19]:

pickle.dump(knn,open('FoodWasteModel.pkl','wb'))
```

3- Developing Dataset-

Framework – Excel

Sr No.	Image	Total row before enhancement	Total Column before enhancement	Total Pixel (Before)
1	1	3456	5184	17915904
2	2	3456	2304	7962624
3	3	5760	3840	22118400
4	4	4599	3648	16777152
5	5	2795	3114	8703630
6	6	3374	5184	17490816
7	7	6000	4000	24000000
8	8	6000	4000	24000000
9	9	3949	5265	20791485
10	10	630	1200	756000
11	11	583	856	499048
12	12	694	703	487882
13	13	183	275	50325
14	14	5414	3817	20665238
15	15	2500	2000	5000000
16	16	2935	4402	12919870
17	17	5184	3456	17915904
18	18	5616	3744	21026304
19	19	4565	3744	17091360
20	20	4608	3456	15925248
21	21	3024	3024	9144576
22	22	4992	3744	18690048
23	23	2869	4304	12348176
24	24	4000	6000	24000000
25	25	6274	5019	31489206
26	26	3695	5542	20477690
27	27	600	600	360000
28	28	1130	1600	1808000

Total row after enhancement	Total column after enhancement	Total Pixel (After)	Total Black Pixel
28	28	784	372
28	28	784	4
28	28	784	581
28	28	784	49
28	28	784	349
28	28	784	480
28	28	784	20
28	28	784	650
28	28	784	184

28	28	784	233
28	28	784	230
28	28	784	534
28	28	784	383
28	28	784	779
28	28	784	249
28	28	784	402
28	28	784	500
28	28	784	110
28	28	784	273
28	28	784	613
28	28	784	168
28	28	784	79
28	28	784	711
28	28	784	214
28	28	784	318
28	28	784	655
28	28	784	216
28	28	784	364

Total White Pixel	Ratio	White Percent	Result
412	1.11	52.551	0
780	195	99.49	0
203	0.35	25.893	1
735	15	93.75	0
435	1.25	55.485	0
304	0.63	38.776	1
756	37.8	96.429	0
134	0.21	17.092	1
600	3.26	76.531	0
551	2.36	70.281	0
554	2.41	70.663	0
250	0.47	31.888	1
401	1.05	51.148	0
5	0.01	0.638	1
535	2.15	68.24	0
382	0.95	48.724	0
284	0.57	36.224	1
674	6.13	85.969	0
511	1.87	65.179	0
171	0.28	21.811	1
616	3.67	78.571	0
705	8.92	89.923	0
73	0.1	9.311	1
570	2.66	72.704	0
466	1.47	59.439	0

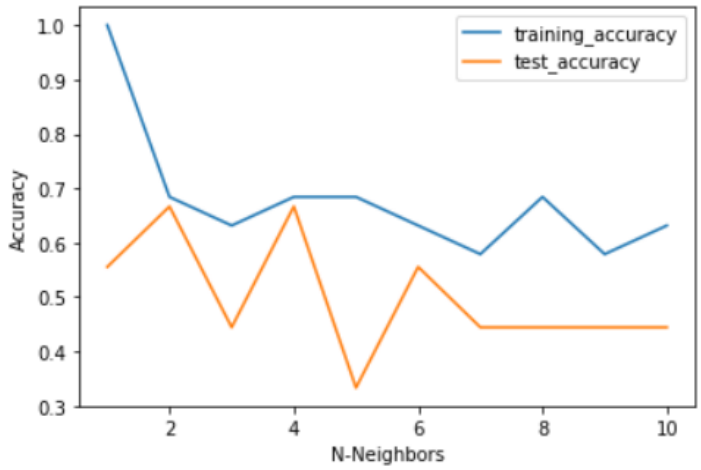
129	0.2	16.454	1
568	2.63	72.449	1
420	1.15	53.571	1

OUTPUT

1- Column name in dataset

```
Index(['Sr No.', 'Image ', 'Total row before enhancement',
       'Total Column before enhancement', 'Total Pixel (Before)',
       'Total row after enhancement', 'Total column after enhancement',
       'Total Pixel (After)', 'Total Black Pixel', 'Total White Pixel',
       'Ratio', 'White Percent', 'Result'],
      dtype='object')
```

2- Accuracy Graph



3- Accuracy on training testing dataset

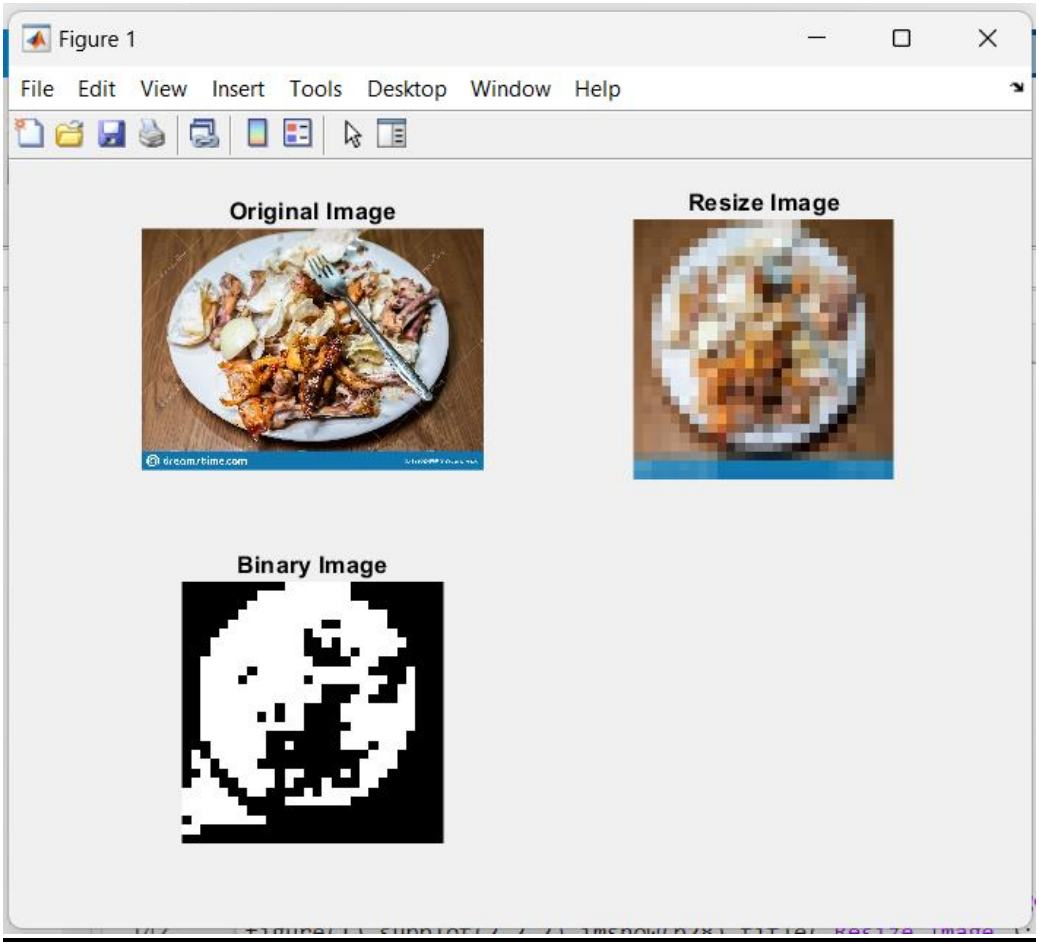
```
Accuracy on training set: 0.63

Accuracy on test set: 0.56
```

4- Detected Output/ Result\

```
'1' indicate you wasted food and '0' indicate you have not wasted food...
User Input Datset:-  [[28, 28, 1130, 1600, 1808000, 28, 28, 784, 364, 420, 1.15, 53.571]]
Ditected Result is:-  [1]
```

5- Output by Matlab framework for a image {as Example}



WORKING

1. Input image is taken from user's gallery,
2. Then image get processed in MATLAB frame i.e., reduce size, converting to binary and counting pixels of same intensity.
3. After that data received from matlab is then computed to excel sheet (calculating ratio and proportion of bright intensity pixel region) to make dataset for Machine Learning operation,
4. Ones the data is completed on excel sheet convert it to csv file (supported file format for data processing),

5. Now the data is transferred to Jupyter framework and processed it by dividing it to 70% data for training and 30% data for testing purpose,
6. After that calculating the accuracy of developed model,
7. Once the accuracy is calculated, plot the graph of accuracy,
8. Now fit the new data in program and you will get output as result.

CONCLUSION AND FUTURE WORK

Conclusion:

As per the goal of this project an attempt is made to show how we can detect the waste meal left by a person in our hostel mess or so.

This model help in reducing the waste generation and also develop a fear of imposing penalty among the person if he/ she waste huge amount of food with certain instruction or restriction.

Future work:-

The present system is just a model of detecting whether the person wasted the food or not with user database but Future work concerns with developing a Admin panel and implementing it over various hardware electronic device and a data base to calculate the average waste generated by user and store products detail with user information.

Github link:-

https://github.com/Yash-Kumar-Gupta-0845/Mini-Project-1