

“A Personalized Nutrient-Based Meal Recommender System”

**A Project Report Submitted to
Rajiv Gandhi Proudhyogiki Vishwavidyalaya**



**Towards Partial Fulfillment for the Award of
Bachelor of Engineering in *Information Technology***

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***Acropolis Institute of Technology & Research, Indore*
Jan – June 2020**

EXAMINER APPROVAL

The Project entitled “***A Personalized Nutrient –Based Meal Recommender System*** ” submitted by **Saksham doshi, Rahul sariya, Rudraksh Shukla, Rohit Sisodiya and Rishi Prajapati** has been examined and is hereby approved towards partial fulfillment for the award of ***Bachelor of Engineering degree in Information Technology*** discipline, for which it has been submitted. It understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein, but approve the project only for the purpose for which it has been submitted.

(Internal Examiner)

Date:

(External Examiner)

Date:

GUIDE RECOMMENDATION

This is to certify that the work embodied in this project entitled “***A Personalized Nutrient –Based Meal Recommender System***” submitted by **Saksham doshi, Rahul sariya, Rudraksh Shukla, Rohit Sisodiya and Rishi Prajapati** a satisfactory account of the bonafide work done under the supervision of ***Dr. Kamal Kumar Sethi***, is recommended towards partial fulfillment for the award of the Bachelor of Engineering (Information Technology) degree by Rajiv Gandhi Proudyogiki Vishwavidhyalaya, Bhopal.

(Project Guide)

(Project Coordinator)

STUDENTS UNDERTAKING

This is to certify that project entitled "***A Personalized Nutrient –Based Meal Recommender System***" has developed by us under the supervision of ***Dr. Kamal Kumar Sethi***. The whole responsibility of work done in this project is ours. The sole intension of this work is only for practical learning and research.

We further declare that to the best of our knowledge, this report does not contain any part of any work which has been submitted for the award of any degree either in this University or in any other University / Deemed University without proper citation and if the same work found then we are liable for explanation to this.

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Executive Summary

A Personalized Nutrient –Based Meal Recommender System

This project is submitted to Rajiv Gandhi Proudyogiki Vishwavidhyalaya, Bhopal(MP), India for partial fulfillment of Bachelor of Engineering in Information Technology branch under the sagacious guidance and vigilant supervision of ***Dr. Kamal Kumar Sethi***.

This project is an approach for recommending healthy and nutritional diet by Data mining algorithms like K neighbors and Decision tree, it envisaged personalized meal on the basis of **Nutrient** user prefer, **disease/medical condition** he has or has been through and particular **diet** he/she wants to maintain, recommender system focuses on every individual based on their eating habits and body statistics, system uses an adapted collaborative filtering approach to recommend food based on healthiness and taste ratings of other users.

Key words : KNN, Collaborative filtering

List of Figures

Figure 1-1 : Content based filtering	3
Figure 1-2: Collaborative filtering	4
Figure 1-3 : Web scraping	4
Figure 3-1 : Block Diagram	16
Figure 3-2 : Initial profile based recommendation	18
Figure 3-3 : User based Recommendation.....	18
Figure 3-4 : Recommendation based on recent activity	18
Figure 3-5 : User's signUp/Login UI.....	19
Figure 3-6 : UI for user to enter his preference	20
Figure 3-7 Final Recommender	20

TABLE OF CONTENT

LETTER OF APPROVAL	i
ACKNOWLEDGEMENT	ii
STUDENT'S DECLARATION	iii
ABSTRACT	iv
LIST OF FIGURES	viii
CHAPTER 1: INTRODUCTION	1
1.1 Background.....	1
1.2 Objectives	2
1.3 Scope.....	2
1.4 Limitation	2
1.5 Report Outline	3
CHAPTER 2: REQUIREMENT AND FEASIBILITY ANALYSIS	4
2.1 Literature Review	4
2.1.1 Content based filtering algorithm	5
2.1.2 Limitations of content based filtering algorithm	5
2.1.3 Related works	6
2.2 Requirement Analysis.....	7
2.2.1 Functional requirement	7
2.2.2 Non-functional requirement	7
2.3 Feasibility Analysis	8

2.3.1 Operational feasibility.....	8
2.3.2 Technical feasibility.....	9
2.3.3 Schedule feasibility.....	9
CHAPTER 3: SYSTEM DEVELOPMENT.....	10
3.1 Methodology and Algorithm.....	10
3.1.1. Data collection.....	10
3.1.2 Data processing.....	10
3.1.3 Algorithm used	11
3.2 System Analysis	11
3.2.1 Sequence diagram.....	12
3.2.2 State diagram.....	13
CHAPTER 4: IMPLEMENTATION AND TESTING	14
4.1 Implementation	14
4.1.1 Tools used	14
4.2 Screenshots	14
4.2.1 screenshots	14
CHAPTER 5: MAINTENANCE.....	26
5.1 Corrective Maintenance.....	26
5.2 Adaptive Maintenance	26
CHAPTER 6: CONCLUSION	27

6.1 Conclusion	27
6.2 Recommendation.....	27
References	28
Bibliography	29

Chapter 1 .Introduction

In this fast and busy schedule life, people are not giving importance to the quality of food they are eating. They tend to neglect their eating patterns and habits. The fast-food consumption rate is alarmingly high and this consequently has led to the intake of unhealthy food. This leads to various health issues such as obesity, diabetes, an increase in blood pressure etc. Hence it has become very essential for people to have a good balanced nutritional healthy diet. There are many applications which are booming to help people so that they can have control over their diet and hence can reduce weight or they can help them to keep them fit and healthy. Food recommendation challenges the way recommender systems are used, since it requires a strong adaption to the domain specific requirements in order to provide individually valid and practically usable health advice. On one hand, user ratings of food taste may be individually reliable in view of using them in a collaborative filtering approach. On the other hand, the variety of nutritional advice available and the difficulty of knowing all ingredients and nutrients in a given meal make it harder for consumers to judge the health value of their meal. Thus a personalized recommender based on expert knowledge may be necessary to provide good results.

1.1 Background and Motivation

People make decisions related to food every day. They all think about what to eat, where to eat, how much nutritional value this food has, can this make me lose weight, can this food make me healthy and other questions. Recommendation systems help the user to make fast decisions in these complex information spaces. Much of this attention is being paid to diet management systems, which have been replacing traditional paper-and-pen methods. These systems include informative content and services, which persuade users to alter their behavior. Due to the popularity of these diet monitoring facilities, these systems hold a vast amount of user preference information, which could be harnessed to personalize interactive features and to increase engagement with the system and the diet program. One such personalized service, ideally suited to informing diet, is a food recommender. This recommender could exploit the nutritional values of the food to inform its recommendations

1.2 Objective

The goal of application is to provide a platform where users find their food according to their personal preferences and build a behavior of living healthy life.

1.3 Scope of the Project

The application can help people who are diet/health conscious. The application is targeted towards a local audience, for now, as of present it can only be used as a web application that recommends food based on their personal preference.

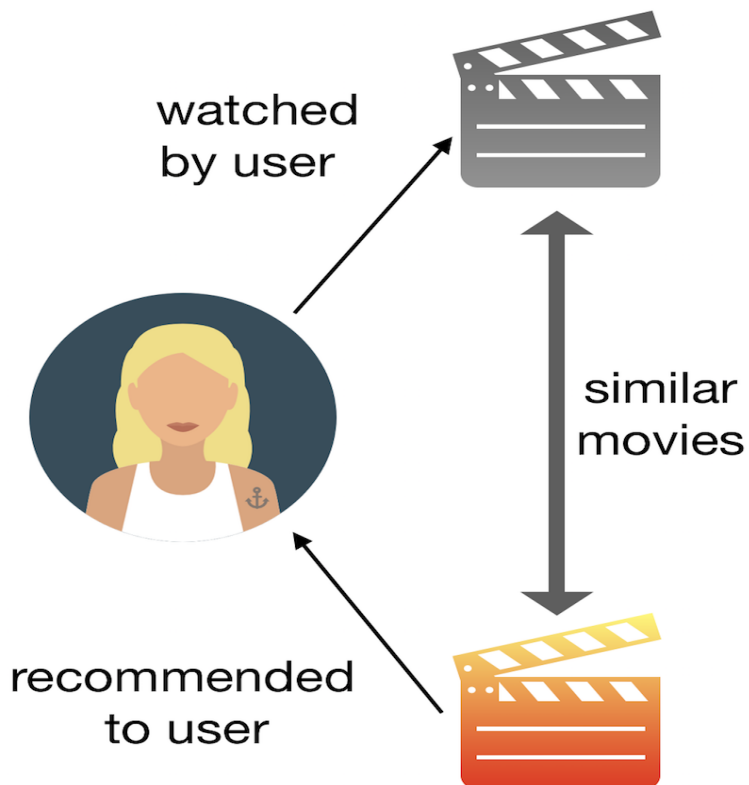
1.4 Report Outline

Preliminary	<ul style="list-style-type: none">• Title Page• Supervisor's Recommendation• Letter of Approval• Acknowledgement• Abstract• Table of Contents• List of figures and Tables
Introduction	<ul style="list-style-type: none">• Background and Motivation• Objective• Scope
Literature Review	<ul style="list-style-type: none">• Food Recommendation System• Content Based Filtering Algorithm
System Development	<ul style="list-style-type: none">• Data collection• Data Processing• Algorithm Used
Test	<ul style="list-style-type: none">• Implementation and testing
Conclusion	<ul style="list-style-type: none">• Successful Recommender

Chapter 2 .Review of Literature

2.1Content based

Content Based Filtering Algorithm: In a content-based recommender system, keywords or attributes are used to describe items. A user profile is built with these attributes. Items are ranked by how closely they match the user attribute profile, and the best matches are recommended. Content-based filtering recommends items based on a comparison between the content of the items and a user profile. The content of each item is represented as a set of descriptors or terms. The user profile is represented with the same terms and built up by analyzing the content of items which have been seen by the u



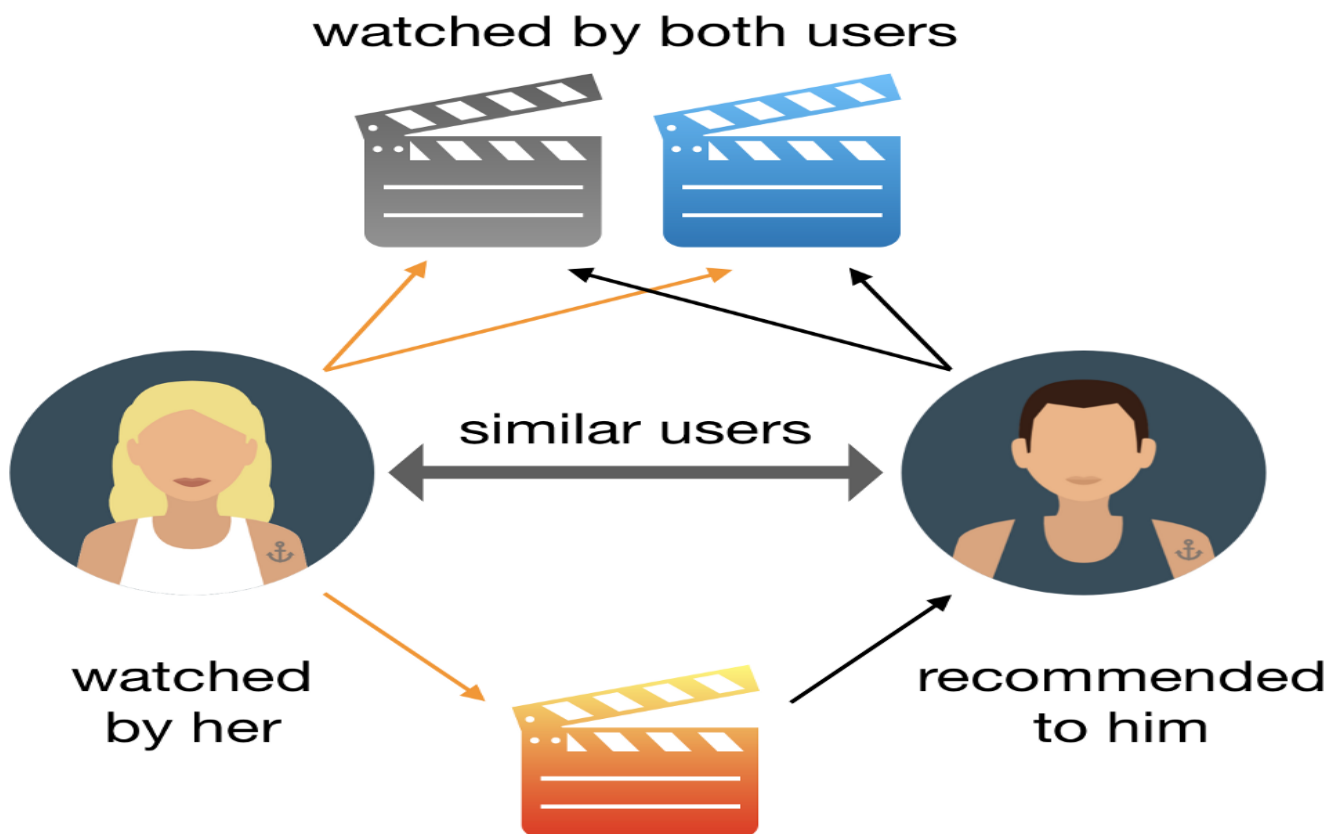
Content-based filtering uses item features to recommend other items similar to what the user likes, based on their previous actions or explicit feedback. The model should recommend items relevant to this user. To do so, you must first pick a similarity metric (for example, dot product). Then, you must set up the system to score each candidate item according to this similarity metric. Note that the recommendations are specific to this user, as the model did not use any information about other users.

2.1.2 Limitations of content based filtering algorithm

- Items and attributes must be machine-recognizable
- . Cannot filter items on some assessment of quality, style or viewpoint. Because of lack of consideration of other people's experience, the system cannot make any assessments of a quality, style or viewpoint for the item
- . Absence of personal recommendations. Due to the lack of consideration of other people's experience, recommendations are based on the item's attributes, tags, among others, and, therefore, missing any personality assessment. Food recommendation system using content based filtering algorithm
- No new items to display: The system is unable to give an item surprisingly interesting to a user, but not expected or possibly foreseen by the user. For example, if a food of the same ingredient has been shown, the user probably already knows about the food and, therefore, is not surprised.

2.1 Collaborative filtering

This type of filter is based on users' rates, and it will recommend us movies that we haven't watched yet, but users similar to us have, and like. To determine whether two users are similar or not, this filter considers the movies both of them watched and how they rated them. By looking at the items in common, this type of algorithm will basically predict the rate of a movie for a user who hasn't watched it yet, based on the similar users' rates.



2.2 Feasibility Analysis

The following result was obtained while performing a feasibility analysis:

2.2.1 Operational feasibility

The end users are the clients of the application. They are the ones who search for the food item. The server keeps the records of all food items and attributes associated with it

2.2.2 Technical feasibility

HTML is used to display content in the browser, CSS to make content look user friendly, and JavaScript for making the web page interactive. At the server side, the logic is implemented using python, Django web framework for dynamic web page generation and to display the predicted result in the browser as well as to handle page requests. A server, client, and internet connection are required to function properly

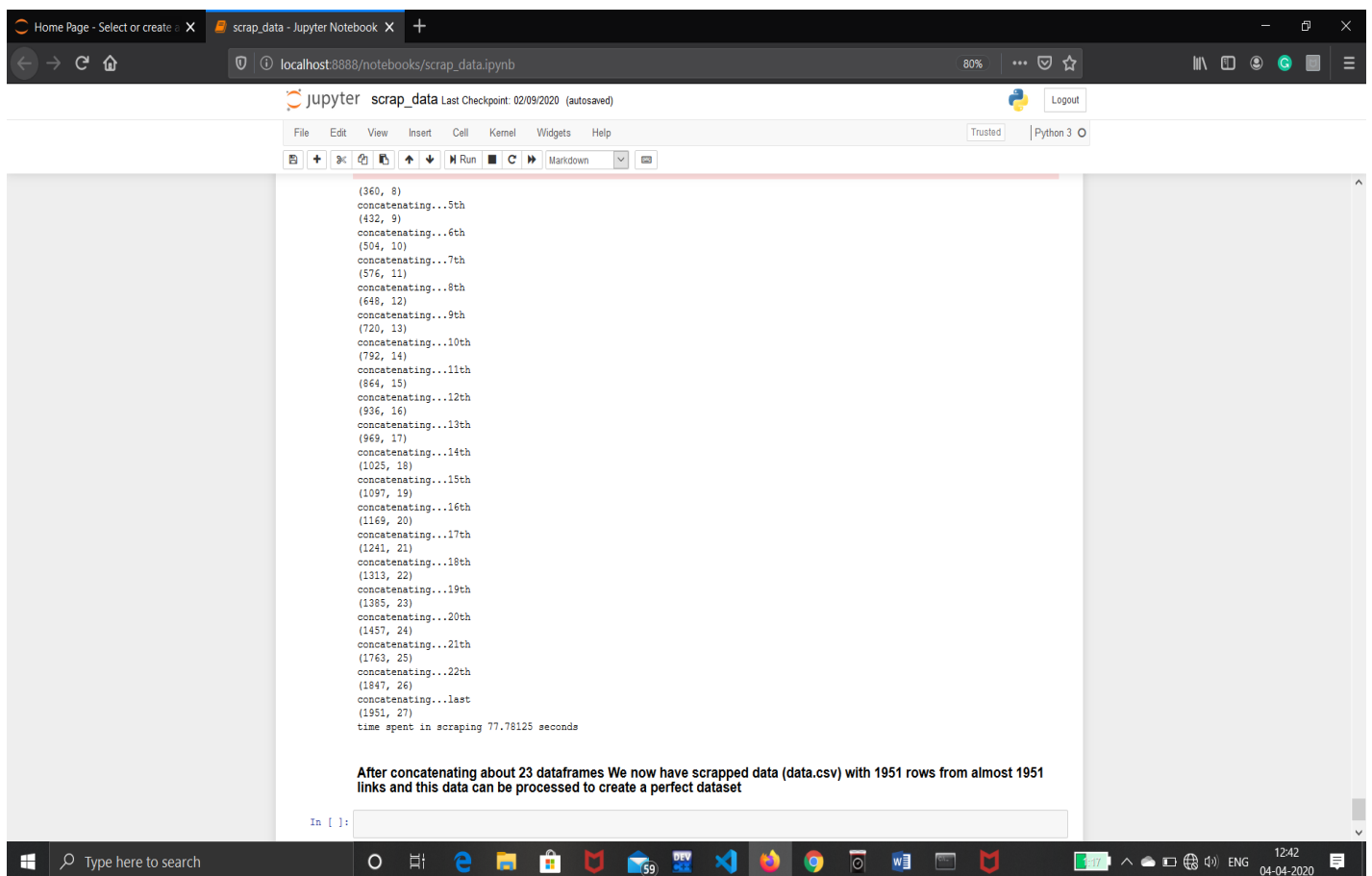
2.2.3 Schedule feasibility

The total estimated time for the development of the application is 1-2 weeks.

Chapter 3 . System Development

3.1 Data collection

Web scraping : The data for system was collected by scraping

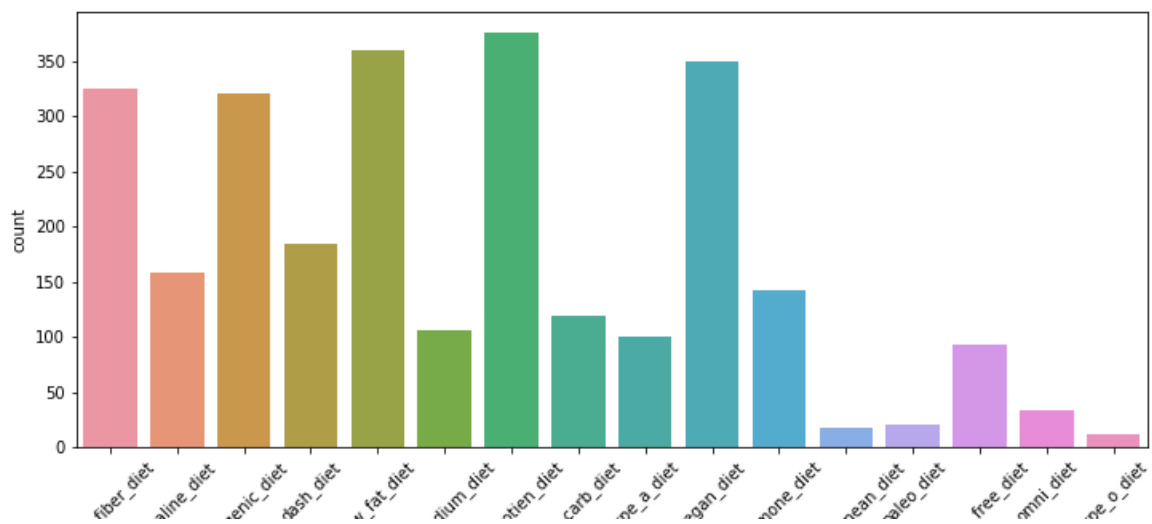
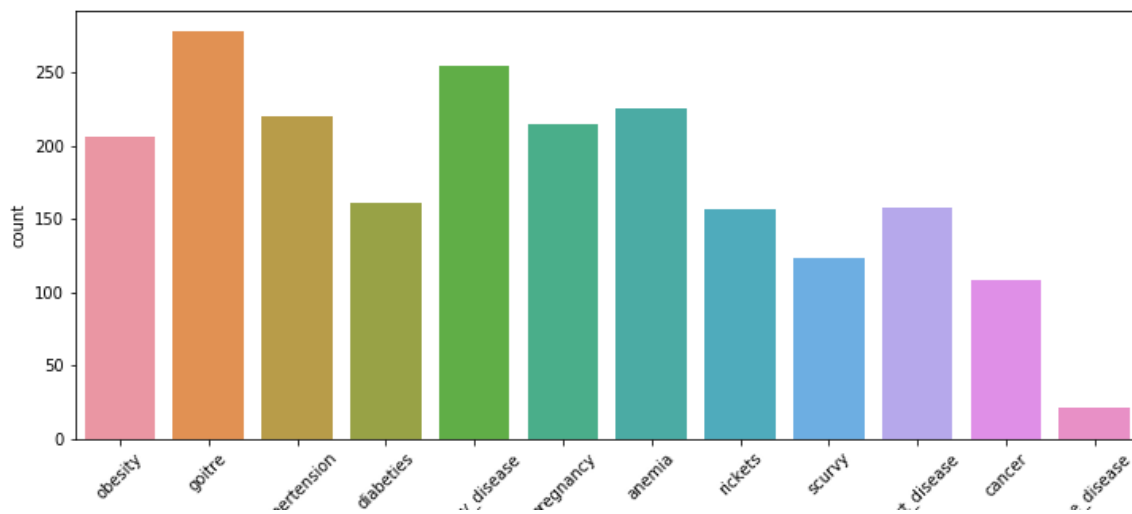
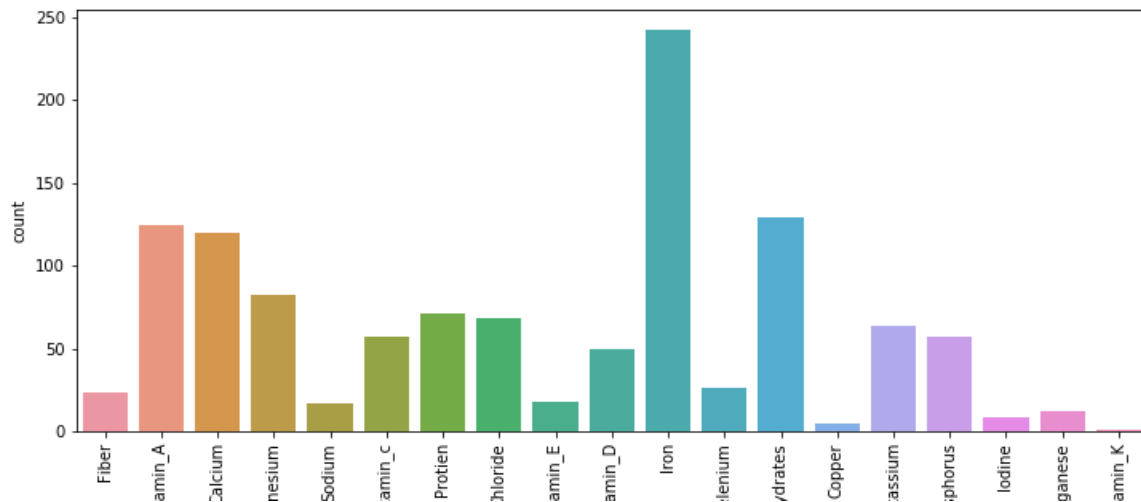


The screenshot displays a Jupyter Notebook window titled 'scrap_data - Jupyter Notebook'. The browser address bar shows 'localhost:8888/notebooks/scrap_data.ipynb'. The notebook interface includes a menu bar (File, Edit, View, Insert, Cell, Kernel, Widgets, Help) and a toolbar with icons for file operations, running cells, and markdown editing. The main content area shows a list of concatenated dataframes, each with a unique identifier and a row count. The list ends with 'concatenating...last (1951, 27)'. Below the list, a text block states: 'time spent in scraping 77.78125 seconds'. At the bottom of the notebook, a summary text reads: 'After concatenating about 23 dataframes We now have scrapped data (data.csv) with 1951 rows from almost 1951 links and this data can be processed to create a perfect dataset'. The Windows taskbar at the bottom shows various application icons and the system clock indicating 12:42 on 04-04-2020.

```
(360, 8)
concatenating...5th
(432, 9)
concatenating...6th
(504, 10)
concatenating...7th
(576, 11)
concatenating...8th
(648, 12)
concatenating...9th
(720, 13)
concatenating...10th
(792, 14)
concatenating...11th
(864, 15)
concatenating...12th
(936, 16)
concatenating...13th
(969, 17)
concatenating...14th
(1025, 18)
concatenating...15th
(1097, 19)
concatenating...16th
(1169, 20)
concatenating...17th
(1241, 21)
concatenating...18th
(1313, 22)
concatenating...19th
(1385, 23)
concatenating...20th
(1457, 24)
concatenating...21th
(1763, 25)
concatenating...22th
(1847, 26)
concatenating...last
(1951, 27)
time spent in scraping 77.78125 seconds
```

After concatenating about 23 dataframes We now have scrapped data (data.csv) with 1951 rows from almost 1951 links and this data can be processed to create a perfect dataset

Data Processing – scrapped data was processed to create a dataset



Final Dataset

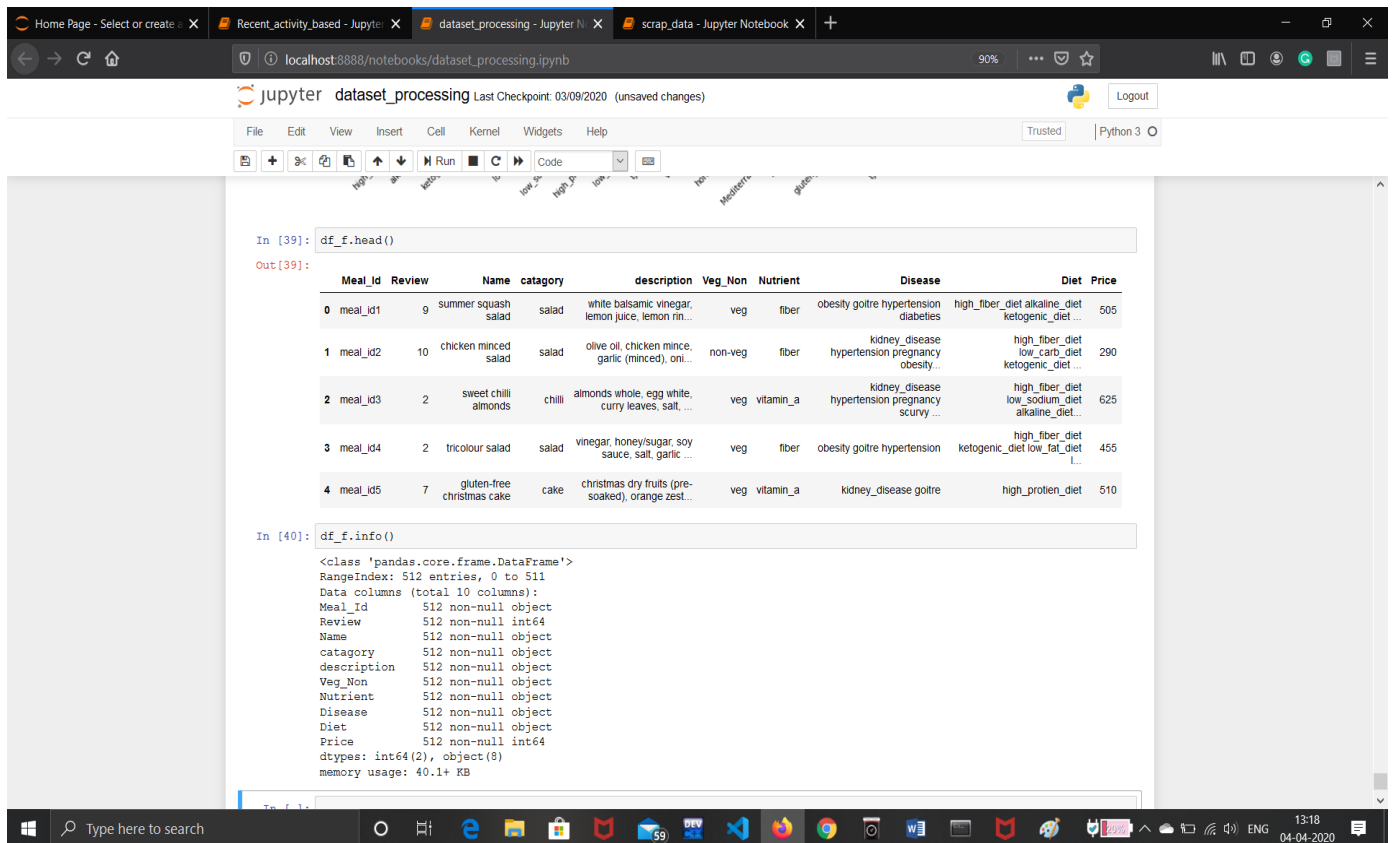
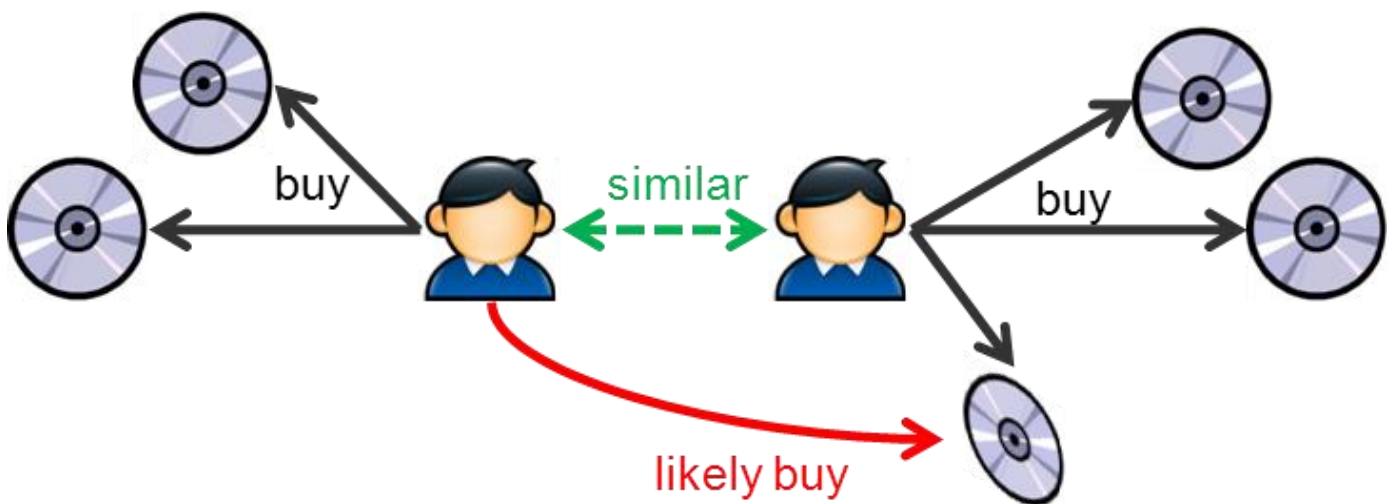


Fig : final Dataset

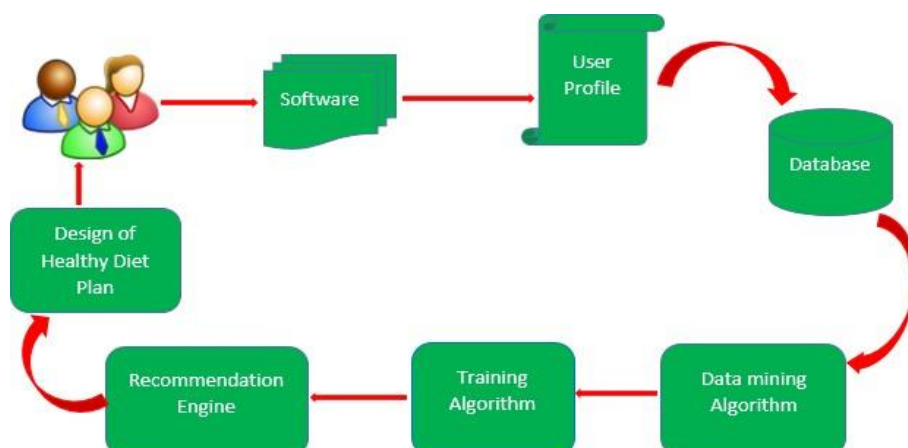
3.2 Algorithms used

Nearest Neighborhood

The standard method of Collaborative Filtering is known as **Nearest Neighborhood** algorithm. There are user-based CF and item-based CF. Let's first look at **User-based CF**. We have an $n \times m$ matrix of ratings, with user u_i , $i = 1, \dots, n$ and item p_j , $j=1, \dots, m$. Now we want to predict the rating r_{ij} if target user i did not watch/rate an item j . The process is to calculate the similarities between target user i and all other users, select the top X similar users, and take the weighted average of ratings from these X users with similarities as weights.



3.3 Block Diagram



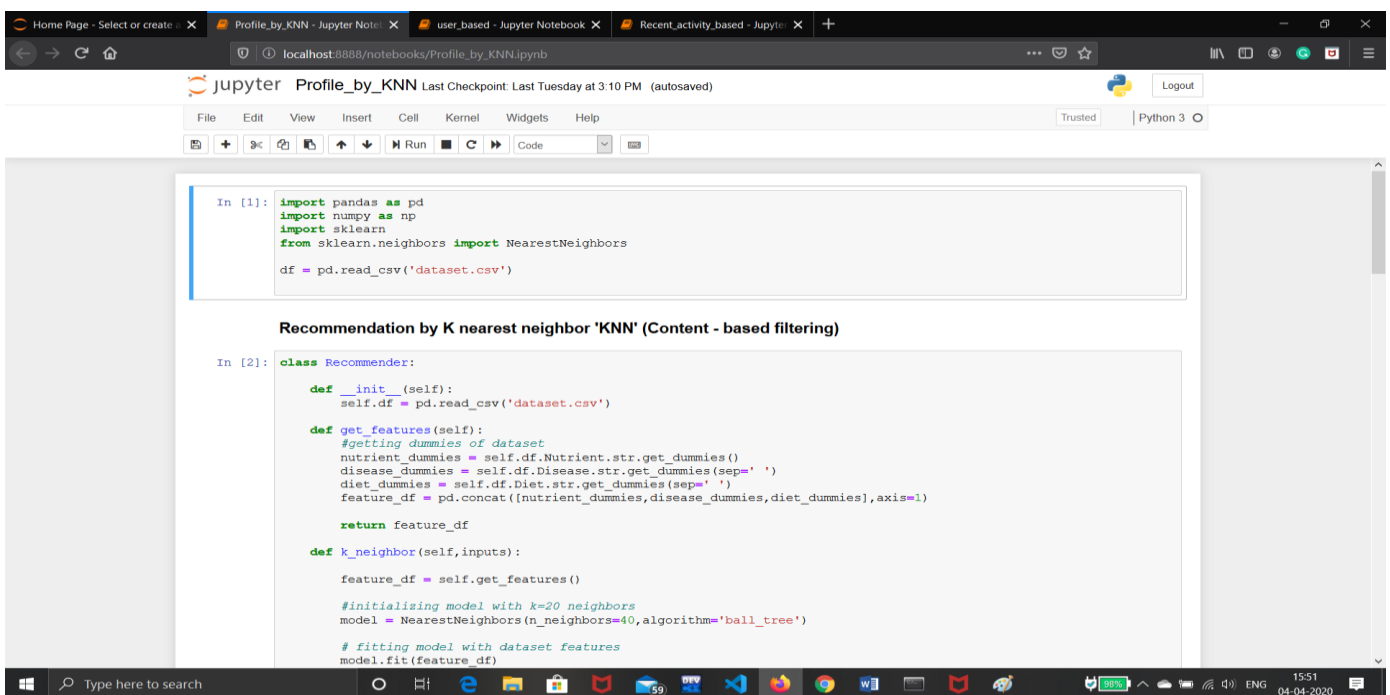
Chapter 4 .Implementation and Testing

For the problem of counting the number of students and vehicles entering the college campus manually, the system is designed in such a way so as to automate the process by placing a camera at the entrance gate so that students, bikes and cars getting inside the college campus can be identified and counted.

4.1 Tools used

The application is based on Django framework , Backend of application is completely based on python and its libraries ,various tools like /jupyter notebook are used to analyze data and dataprocessing while the frontend consist of HTML5, CSS3 and bootstrap4 to develop a good user interface ,for database csv files mysqlite are used.

4.2 Implementation screenshots



```
In [1]: import pandas as pd
import numpy as np
import sklearn
from sklearn.neighbors import NearestNeighbors
df = pd.read_csv('dataset.csv')
```

Recommendation by K nearest neighbor 'KNN' (Content - based filtering)

```
In [2]: class Recommender:
def __init__(self):
self.df = pd.read_csv('dataset.csv')

def get_features(self):
#getting dummies of dataset
nutrient_dummies = self.df.Nutrient.str.get_dummies()
disease_dummies = self.df.Disease.str.get_dummies(sep=' ')
diet_dummies = self.df.Diet.str.get_dummies(sep=' ')
feature_df = pd.concat([nutrient_dummies,disease_dummies,diet_dummies],axis=1)

return feature_df

def k_neighbor(self,inputs):
feature_df = self.get_features()

#initializing model with k=20 neighbors
model = NearestNeighbors(n_neighbors=40,algorithm='ball_tree')

# fitting model with dataset features
model.fit(feature_df)
```

Fig: Initial Profile creation by User preference

Home Page - Select or create x Profile_by_KNN - Jupyter Note... user_based - Jupyter Notebook x Recent_activity_based - Jupyter x +

localhost:8888/notebooks/user_based.ipynb

Jupyter user_based Last Checkpoint: Last Wednesday at 10:35 PM (autosaved)

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run

User based Recommendation (Collaborative filtering)

- if user A and user B share similar profile then meal liked by User B but not rated by A are recommended to A
- User-based: measure the similarity between target users and other users
- Collaborative filtering systems make recommendations based on historic users' preference for items (clicked, watched, purchased, liked, rated, etc.).

Algorithm - K_Nearest-neighbor

```
In [6]: import pandas as pd
import numpy as np
import sklearn
from sklearn.neighbors import NearestNeighbors

df_profile = pd.read_csv('user_profiles.csv')
df_activity = pd.read_csv('user_activity.csv')
df_profile.head(3)
```

```
Out [6]:
```

	User_Id	Veg_Non	Nutrient	Disease	Diet
0	User_1	non-veg	chloride	rickets goitre pregnancy kidney_disease anemia	hormone_diet low_carb_diet high_protein_diet ...
1	User_2	veg	carbohydrates	diabetes goitre	high_fiber_diet high_protein_diet low_fat_die...
2	User_3	non-veg	iron	rickets goitre pregnancy kidney_disease anemia	high_fiber_diet hormone_diet low_carb_diet hi...

```
In [7]: df_activity.head(3)
```

```
Out [7]:
```

	User_Id	Name	category	description	Veg_Non	Review	Nutrient	Disease	Diet	Price
0	User_98	summer squash salad	salad	white balsamic vinegar, lemon juice, lemon rin...	veg	10	fiber	diabetes hypertension obesity goitre	high_fiber_diet high_protein_diet dash_diet k...	320

Type here to search

15:55 04-04-2020

Fig: Recommendation based on user past orders

Home Page - Select or create x Profile_by_KNN - Jupyter Note... user_based - Jupyter Notebook x Recent_activity_based - Jupyter x +

localhost:8888/notebooks/Recent_activity_based.ipynb

Jupyter Recent_activity_based Last Checkpoint: Last Thursday at 11:07 AM (autosaved)

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Code

Recommendations based on Recent activities for items (clicked, watched, purchased, liked, rated, etc.).

- Recent search history
- Recently liked
- Recently rated
- Timestamp of activity

```
In [67]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from collections import Counter

df = pd.read_csv('recent_activity.csv')
df_data = pd.read_csv('dataset.csv')
df.head(10)
```

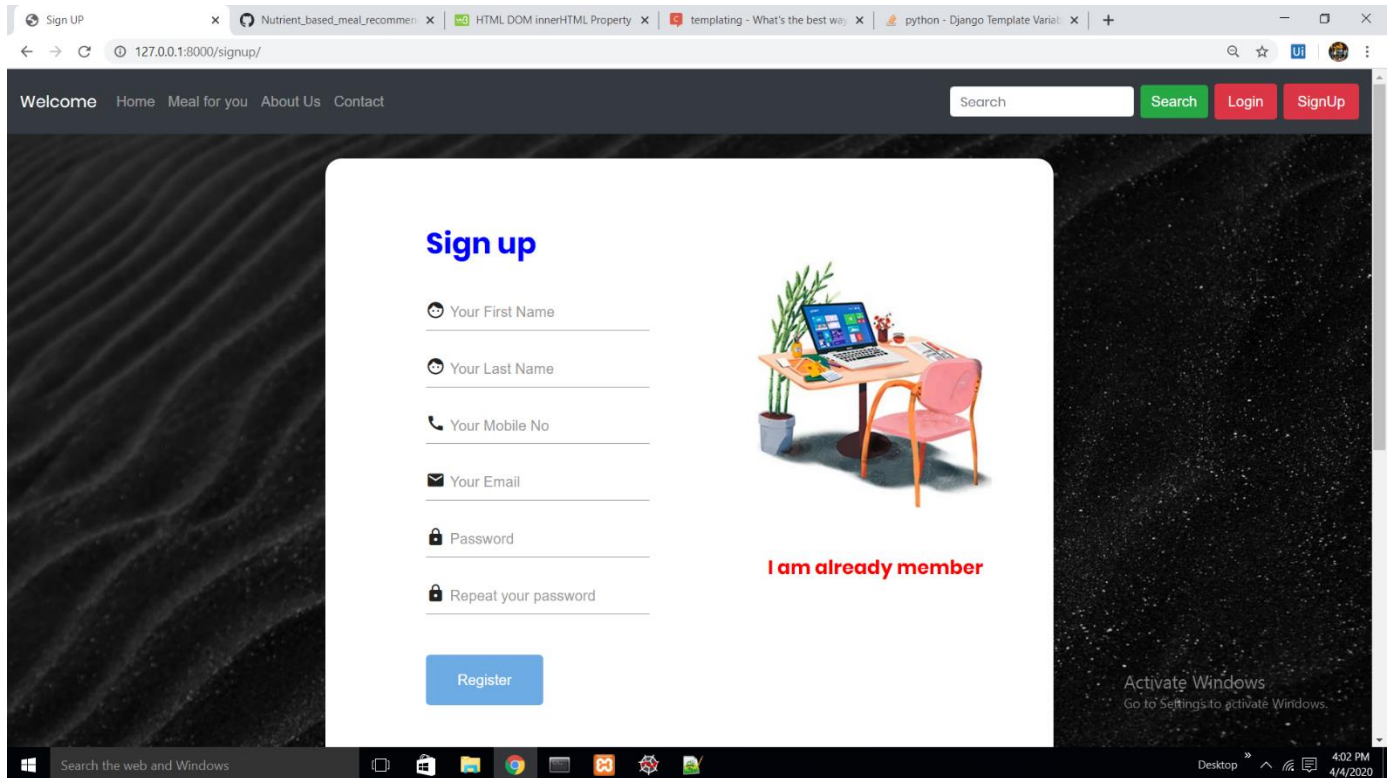
```
Out [67]:
```

	Meal_Id	Rated	Liked	Searched	Timestamp
0	meal_id2	0	1	0	2020-03-01 14:03:58
1	meal_id11	0	0	1	2020-03-02 00:06:48
2	meal_id16	0	1	0	2020-03-02 06:08:30
3	meal_id18	0	1	0	2020-03-02 14:10:46
4	meal_id19	0	0	1	2020-03-03 20:19:16
5	meal_id24	0	0	1	2020-03-04 22:26:38
6	meal_id29	1	0	0	2020-03-06 10:36:50
7	meal_id31	0	0	1	2020-03-06 16:38:32

Type here to search

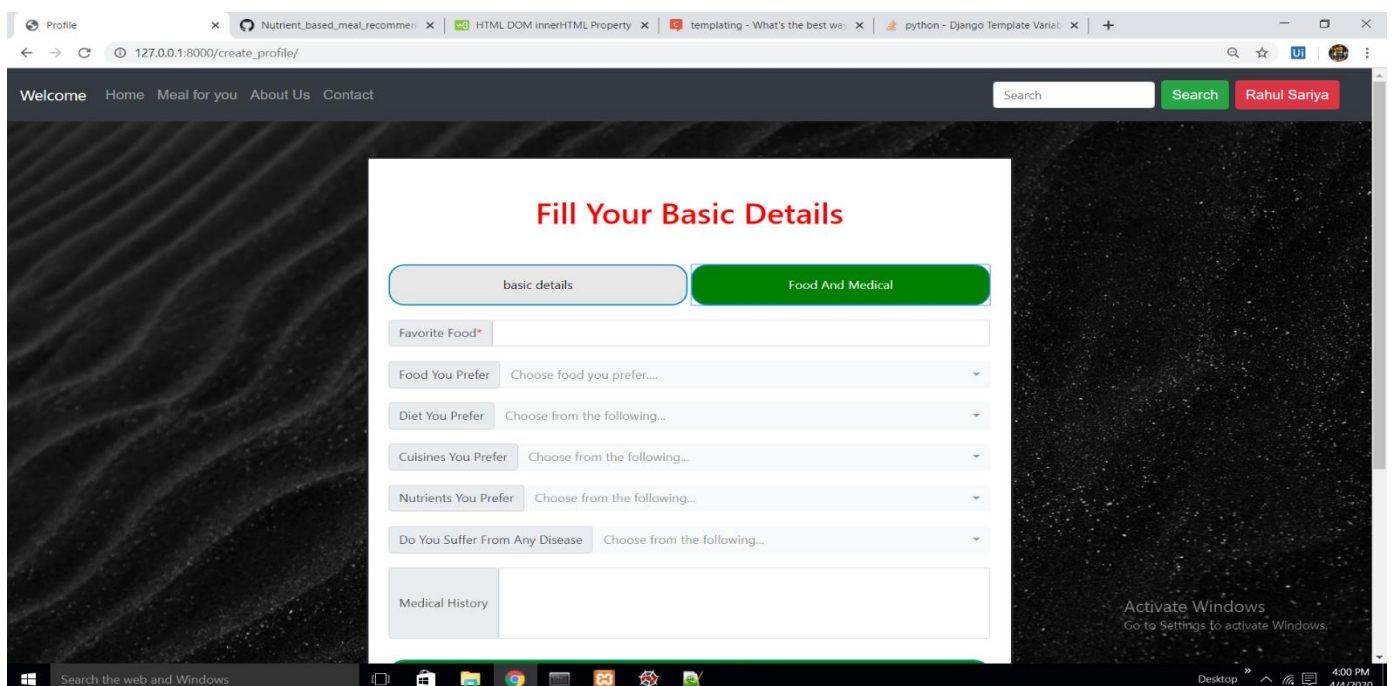
15:56 04-04-2020

Fig: Recommendation based on User's recent activity



The screenshot shows a web browser window with the URL `127.0.0.1:8000/signup/`. The page has a dark header with navigation links: [Welcome](#), [Home](#), [Meal for you](#), [About Us](#), and [Contact](#). On the right of the header is a search bar and three buttons: [Search](#) (green), [Login](#) (red), and [SignUp](#) (red). The main content area features a white card with the title **Sign up** in blue. Below the title are six input fields with icons: **Your First Name**, **Your Last Name**, **Your Mobile No**, **Your Email**, **Password**, and **Repeat your password**. To the right of these fields is an illustration of a desk with a laptop, a potted plant, and a pink chair. Below the illustration is the text **I am already member** in red. At the bottom of the card is a blue **Register** button. The Windows taskbar at the bottom shows the time as 4:02 PM on 4/4/2020.

Fig: Signup/login interface



The screenshot shows a web browser window with the URL `127.0.0.1:8000/create_profile/`. The page has a dark header with navigation links: [Welcome](#), [Home](#), [Meal for you](#), [About Us](#), and [Contact](#). On the right of the header is a search bar and two buttons: [Search](#) (green) and [Rahul Saniya](#) (red). The main content area features a white card with the title **Fill Your Basic Details** in red. Below the title are two tabs: **basic details** (selected) and **Food And Medical** (green). The **basic details** tab contains several form fields: **Favorite Food*** (text input), **Food You Prefer** (dropdown menu), **Diet You Prefer** (dropdown menu), **Cuisines You Prefer** (dropdown menu), **Nutrients You Prefer** (dropdown menu), **Do You Suffer From Any Disease** (dropdown menu), and **Medical History** (text input). The Windows taskbar at the bottom shows the time as 4:00 PM on 4/4/2020.

Fig: UI for User preference

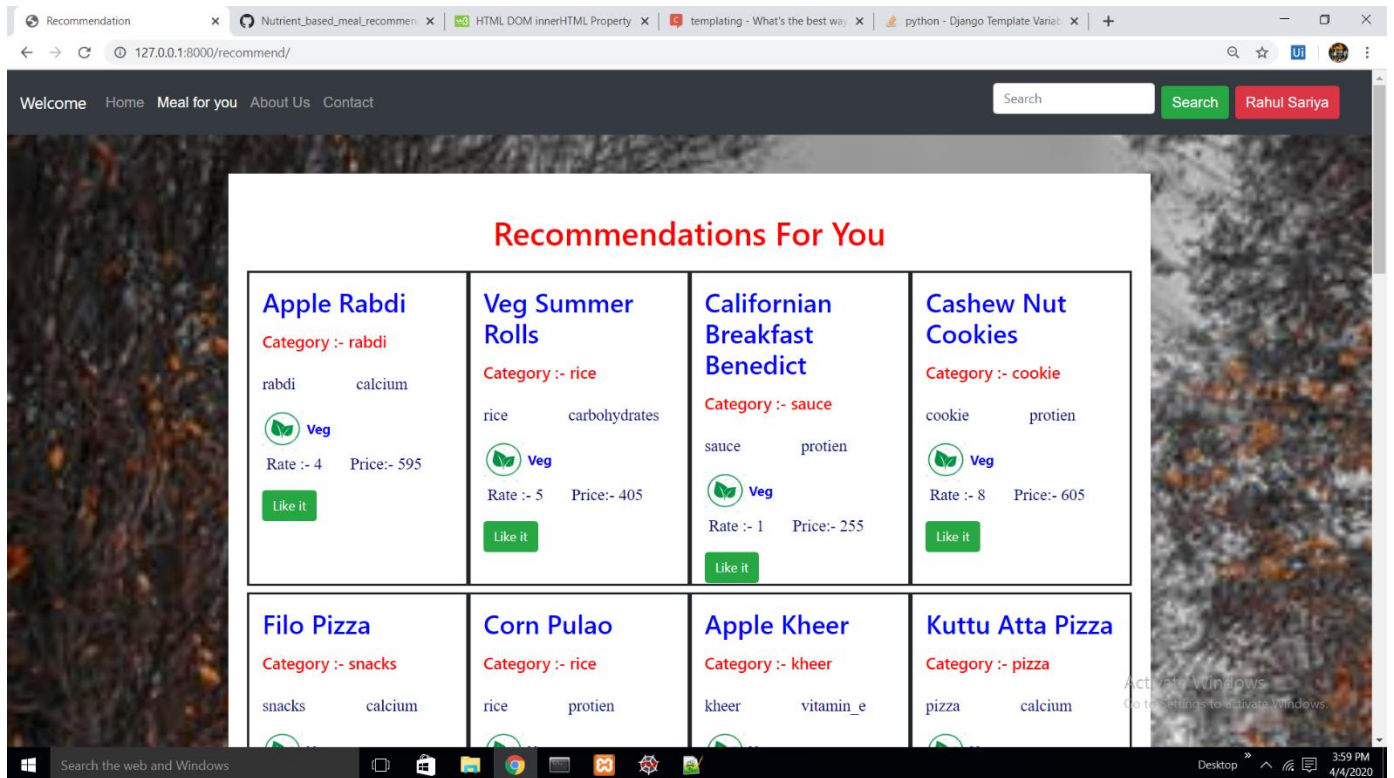


Fig: Final Recommendations for user

CHAPTER 5: MAINTENANCE

5.1 Corrective Maintenance

As application could be sold or deployed for public use. There could be unresolved issues and if a user complains about it, the maintenance has to be done.

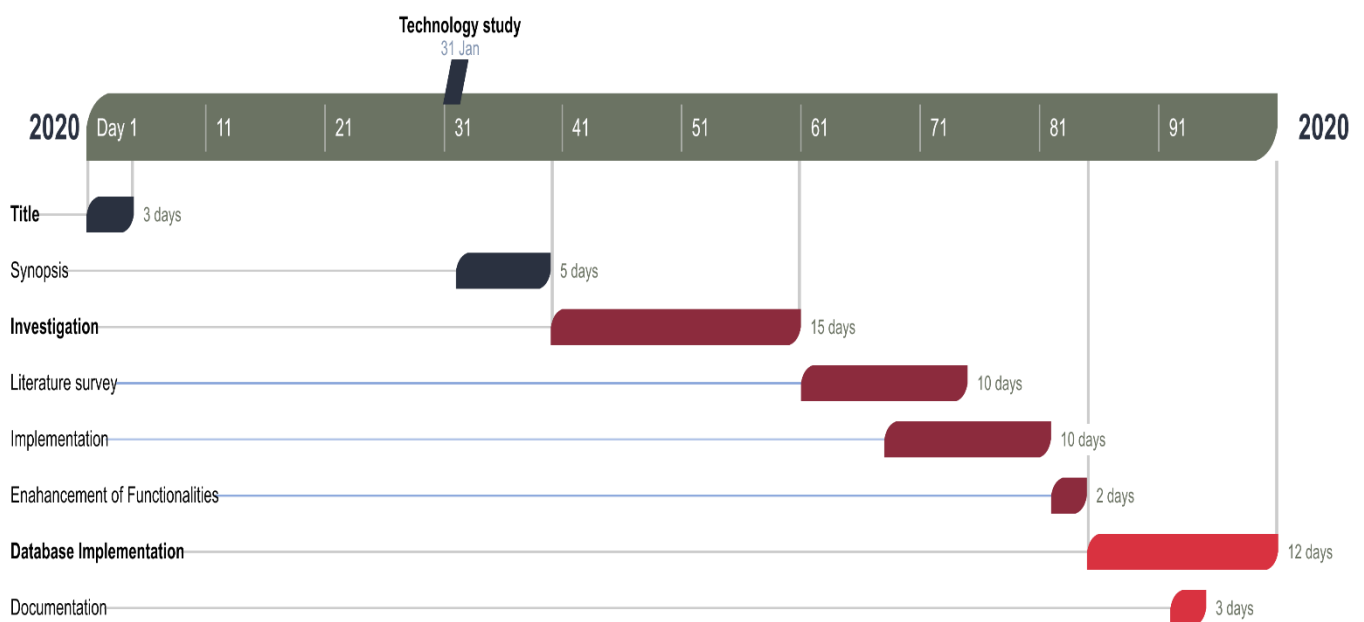
5.2 Adaptive Maintenance

The data in the application does not include all the ingredients and food items, thus the data needs to be updated in future.

Project Plan

Gantt Chart

A Personalized Meal Recommender System



CHAPTER 6: CONCLUSION

6.1 Conclusion

The project Meal Recommendation System was successfully completed by using Content Based and collaborative Filtering by K nearest Neighbor Algorithm. The data set were collected by web scraping which was preprocessed on the basis attributes. The data were then used to model the system.

6.2 Recommendation

The data in the application is based on the data received from web scraping. In order to further improve this product, it is important to collect data of all the ingredients and food items.

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