CSE508 KNOWLEDGE BASED EXPERT SYSTEMS

Diet RECOMMENDATION SYSTEM

Submitted to:

Miss Nandini Sethi

Submitted By:

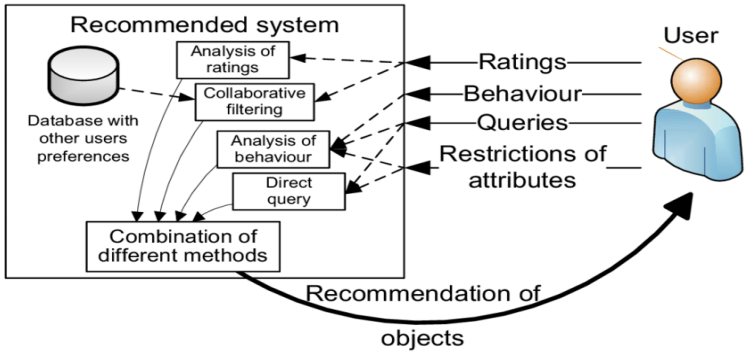
Vishal Verma (11615139)
Izhar Alam (11611189)
Shreyas Arya (11614064)
Bharat Kapila (11601898)

ABSTRACT-

Your food choices each day affect your health — how you feel today, tomorrow, and in the future. Good nutrition is an important part of leading a healthy lifestyle. Combined with physical activity, your diet can help you to reach and maintain a healthy weight, reduce your risk of chronic diseases (like heart disease and cancer), and promote your overall health. A balanced diet is one that gives your body the nutrients it needs to function correctly. The number of calories in a food is a measurement of the amount of energy stored in that food. Your body uses calories from food for walking, thinking, breathing, and other important functions. The average person needs to eat about 2,000 calories every day to maintain their weight. However, a person's specific daily calorie intake can vary depending on their age, gender, and physical activity level. Men generally need more calories than women, and people who exercise need more calories than people who don't.

1. INTRODUCTION-

One of the major factors for a healthy life is daily diet and food, specifically, for the people suffering from some minor or major diseases. eHealth initiatives and research efforts aim to offer various pervasive applications for novice end users to improve their health. Various studies depict that inappropriate and inadequate intake of diet is the major reasons of various health issues and diseases. A study conducted by World Health Organization (WHO) estimates that around 30% of the total population of the world is suffering from various diseases, and 60% deaths each year in children are related to malnutrition. Another study by WHO reports that inadequate and imbalanced intake of food causes around 9% of heart attack deaths, about 11% of ischemic heart disease deaths, and 14% of gastrointestinal cancer deaths worldwide. Moreover, around 0.25 billion children are suffering from Vitamin-A deficiency, 0.2 billion people are suffering from iron deficiency (anemia), and 0.7 billion people are suffering from iodine deficiency. The main focus of this work is to provide dietary assistance to different people who are suffering from common diseases or maybe no diseases. A recommender system, or a recommendation system (sometimes replacing 'system' with a synonym such as platform or engine), is a subclass of information filtering system that seeks to predict the "rating" or "preference" a user would give to an item. They are primarily used in commercial applications.



The recommendation process has basically three stages that are Information Collection Phase, Learning Phase and Recommendation Phase. The information is firstly collected about a particular problem and the various solutions related to that problem are categorized. After the collection of information Learning Phase comes in which various conclusions are made out of that information which is gathered and in last phase i.e. Recommendation Phase an output is given in which various recommendations are made. In our system since it is a diet recommendation system so the recommendations will be about the diet plan like what all things you should

eat, what is your BMI (Body Mass Index) which states whether you are healthy, overweight, or under-weight.

Techniques used for building a Recommendation System-

1.1 **Content based Filtering Method-** The content-based method is a domain-dependent algorithm which focuses on much more on the evaluation of the characteristics of things to produce predictions. When files like pages, publications as well as news are being suggested, the content-based filtering strategy is probably the most profitable. In a content-based filtering technique, the suggestion is made based upon the person profiles with features obtained from the information in the things the person has examined in previous times.

1.2 **Collaborative based Filtering Method-** Collaborative filtering is a domain-independent prediction technique for content that cannot easily and adequately be described by metadata such as movies and music. Collaborative filtering technique works by building a database (user-item matrix) of preferences for items by users. In the newer, narrower sense, collaborative filtering is a method of making automatic predictions (filtering) about the interests of a user by collecting preferences or taste information from many users (collaborating). The underlying assumption of the collaborative filtering approach is that if a person *A* has the same opinion as a person *B* on an issue, A is more likely to have B's opinion on a different issue than that of a randomly chosen person.

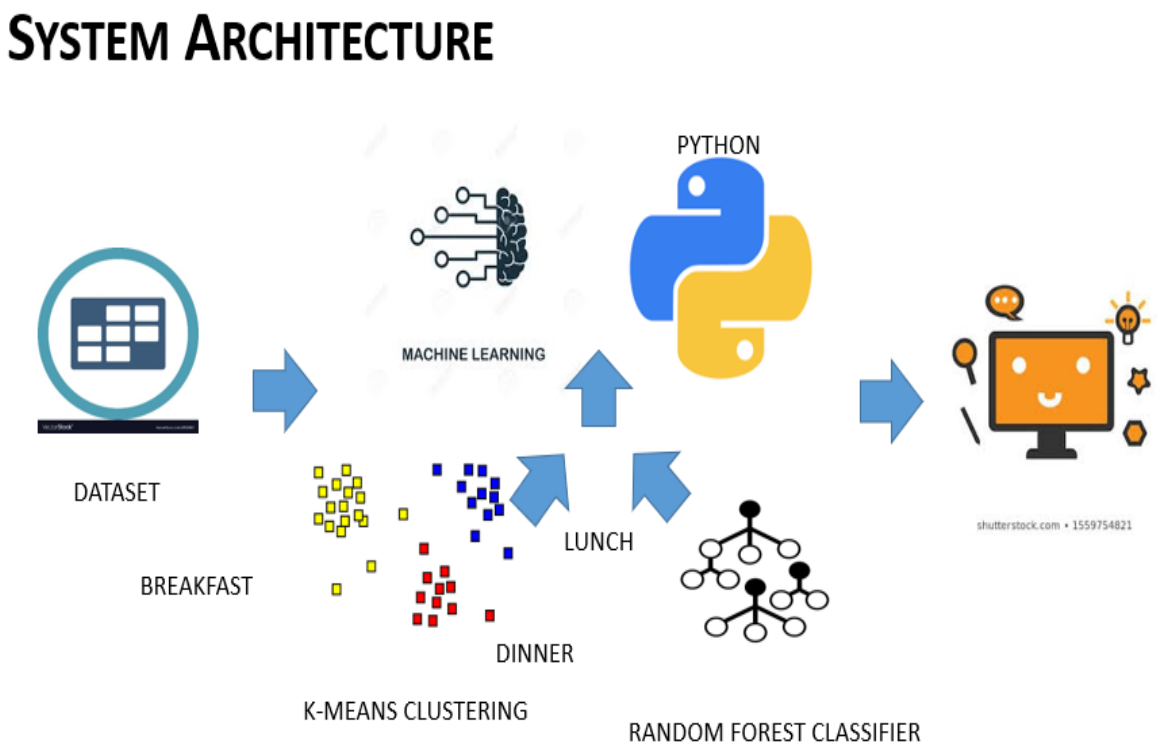
a. **Memory based Filtering Method-** The items that have been previously rated by the user before play a pertinent part in looking for a neighbor that shares appreciation with him. When a neighbor of a person is found, various algorithms could be utilized combining the tastes of friends to produce recommendations. Because of the usefulness of these strategies, they've accomplished extensive results in real-life applications.

b. **Model based Filtering Method-** In this approach, models are developed using different data mining, machine learning algorithms to predict users' rating of unrated items. There are many model-based CF algorithms. Bayesian networks, clustering models, latent semantic models such as singular value decomposition, probabilistic latent

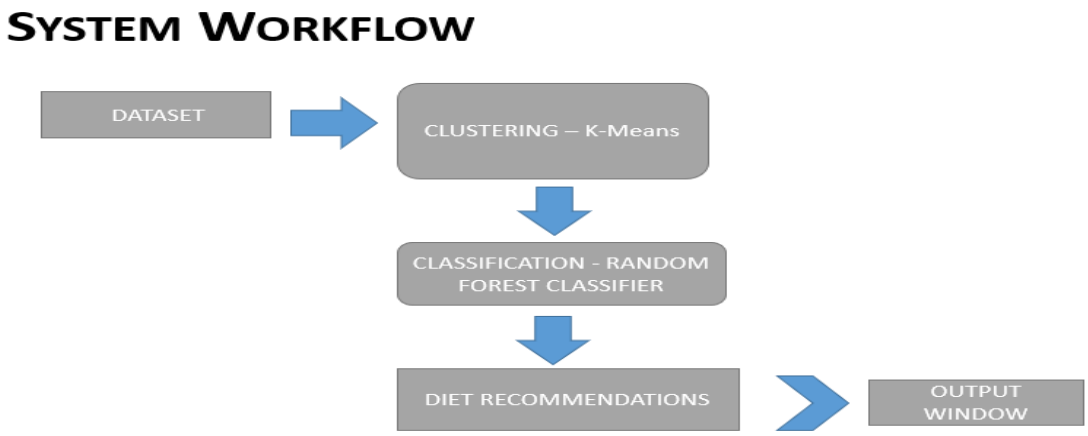
semantic analysis, multiple multiplicative factor, latent Dirichlet allocation and Markov decision process based models.

1.3 Hybrid based Filtering Method- A number of applications combine the memory-based and the model-based CF algorithms. These overcome the limitations of native CF approaches and improve prediction performance. Importantly, they overcome the CF problems such as sparsity and loss of information. However, they have increased complexity and are expensive to implement. Usually most commercial recommender systems are hybrid, for example, the Google news recommender system.

2. SYSTEM ARCHITECTURE:



3. SYSTEM WORKFLOW:



4. PROPOSED WORK:

This project has been developed using Machine Learning algorithms. KMeans clustering was used to cluster the food according to calories and then Random Forest Classifier is used to classify the food items and predict the food items based on input given.

4.1 **Header files used**:

```
import pandas as pd
import numpy as np
from tkinter import *
from sklearn.cluster import KMeans
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
```

Pandas was used to read datasets.

Numpy was used to convert features into numpy and then perform the further operations.

Tkinter was used to create interface.

KMeans was used to perform clustering.

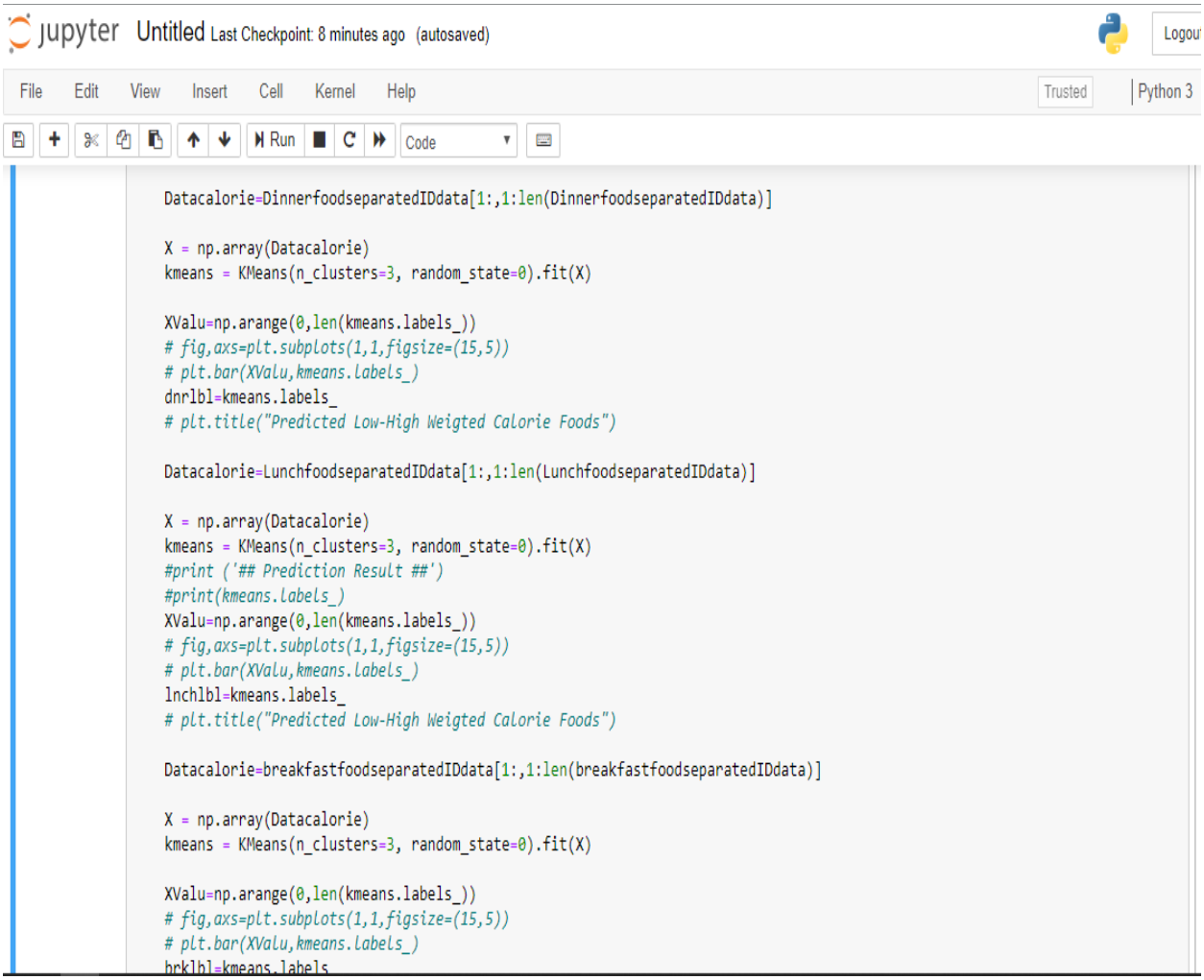
Train_test_split was used to divide the dataset into train and test portions to train and test the model.

RandomForestClassifier used to predict the food items based on clustered data.

4.2 **Reading the dataset**:

```
data=pd.read_csv('food.csv')
Breakfastdata=data['Breakfast']
BreakfastdataNumpy=Breakfastdata.to_numpy()

Lunchdata=data['Lunch']
LunchdataNumpy=Lunchdata.to_numpy()

Dinnerdata=data['Dinner']
DinnerdataNumpy=Dinnerdata.to_numpy()
Food_itemsdata=data['Food_items']
```

4.3 Applying KMeans for clustering on Lunch_data, Breakfast_data, Dinner data:



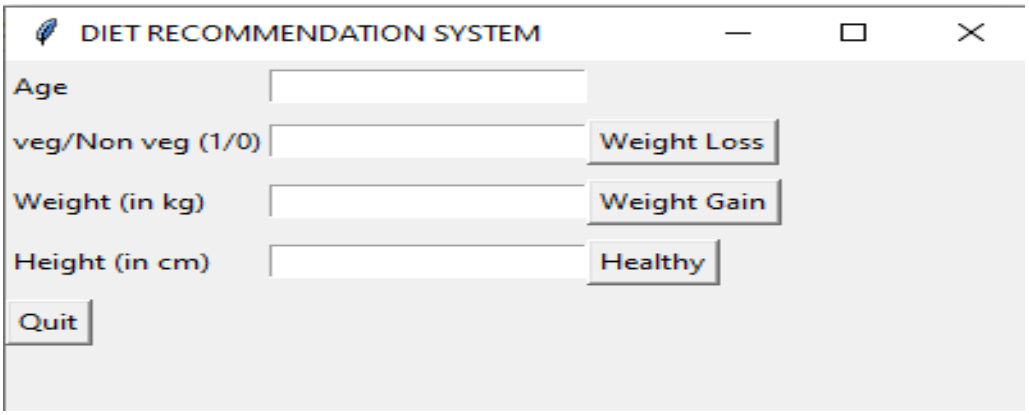
4.4 Applying Random Forest Classifier:

```
#Create a Gaussian Classifier
clf=RandomForestClassifier(n_estimators=100)

#Train the model using the training sets y_pred=clf.predict(X_test)
clf.fit(X_train,y_train)


X_test2=X_test
y_pred=clf.predict(X_test)
```

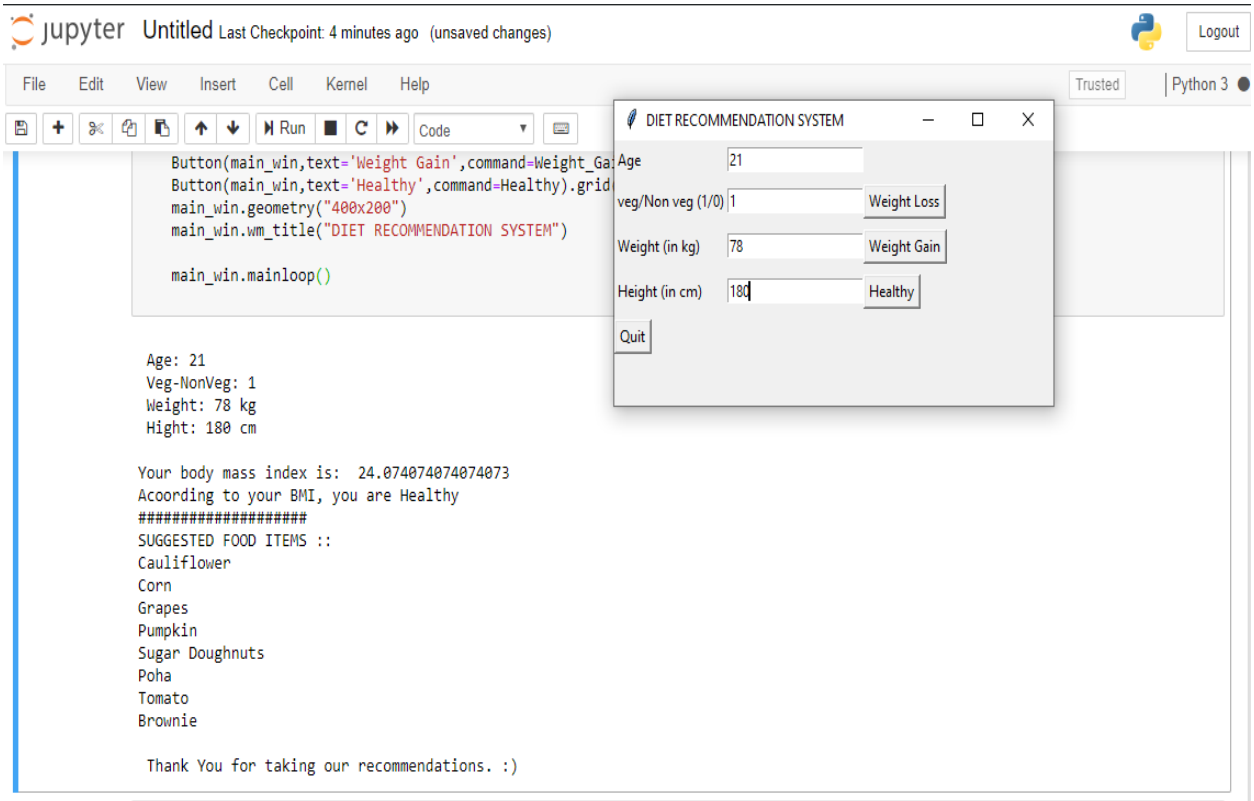
4.5 Creating Interface:

```
if __name__ == '__main__':
    main_win = Tk()

    Label(main_win,text="Age").grid(row=0,column=0,sticky=W,pady=4)
    Label(main_win,text="veg/Non veg (1/0)").grid(row=1,column=0,sticky=W,pady=4)
    Label(main_win,text="Weight (in kg)").grid(row=2,column=0,sticky=W,pady=4)
    Label(main_win,text="Height (in cm)").grid(row=3,column=0,sticky=W,pady=4)

    e1 = Entry(main_win)
    e2 = Entry(main_win)
    e3 = Entry(main_win)
    e4 = Entry(main_win)

    e1.grid(row=0, column=1)
    e2.grid(row=1, column=1)
    e3.grid(row=2, column=1)
    e4.grid(row=3, column=1)

    Button(main_win,text='Quit',command=main_win.quit).grid(row=5,column=0,sticky=W,pady=4)
    Button(main_win,text='Weight Loss',command=Weight_Loss).grid(row=1,column=4,sticky=W,pady=4)
    Button(main_win,text='Weight Gain',command=Weight_Gain).grid(row=2,column=4,sticky=W,pady=4)
    Button(main_win,text='Healthy',command=Healthy).grid(row=3,column=4,sticky=W,pady=4)
    main_win.geometry("400x200")
    main_win.wm_title("DIET RECOMMENDATION SYSTEM")

    main_win.mainloop()
```

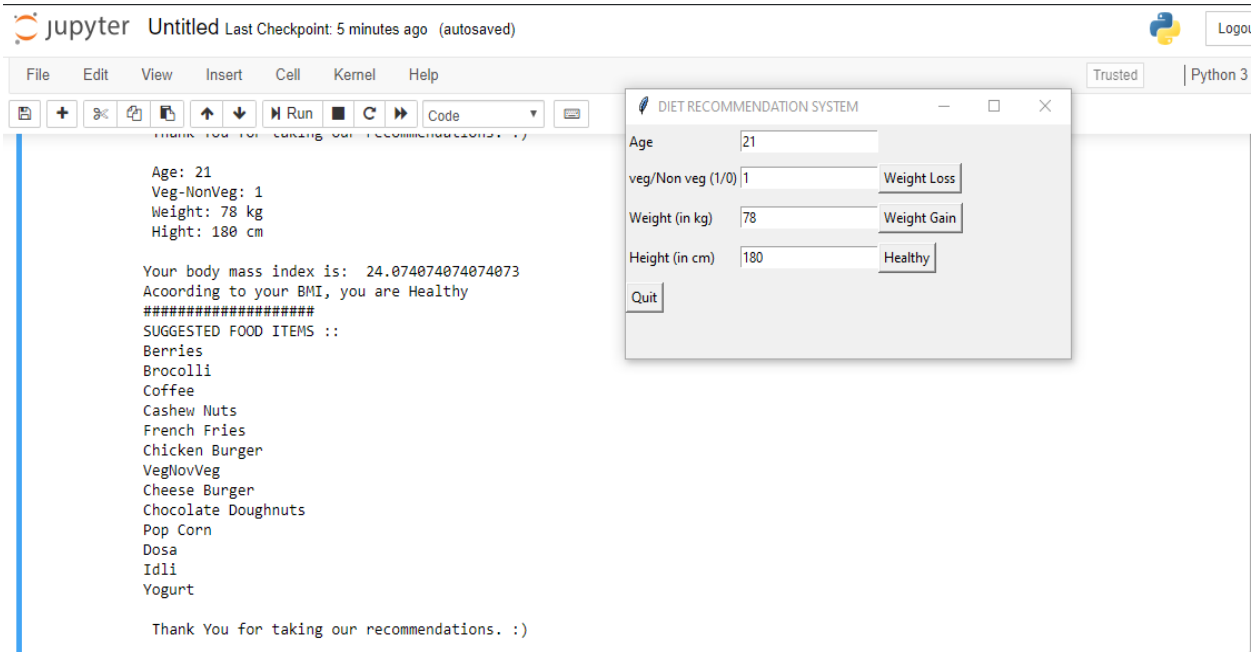
4.6 **Taking Input**:



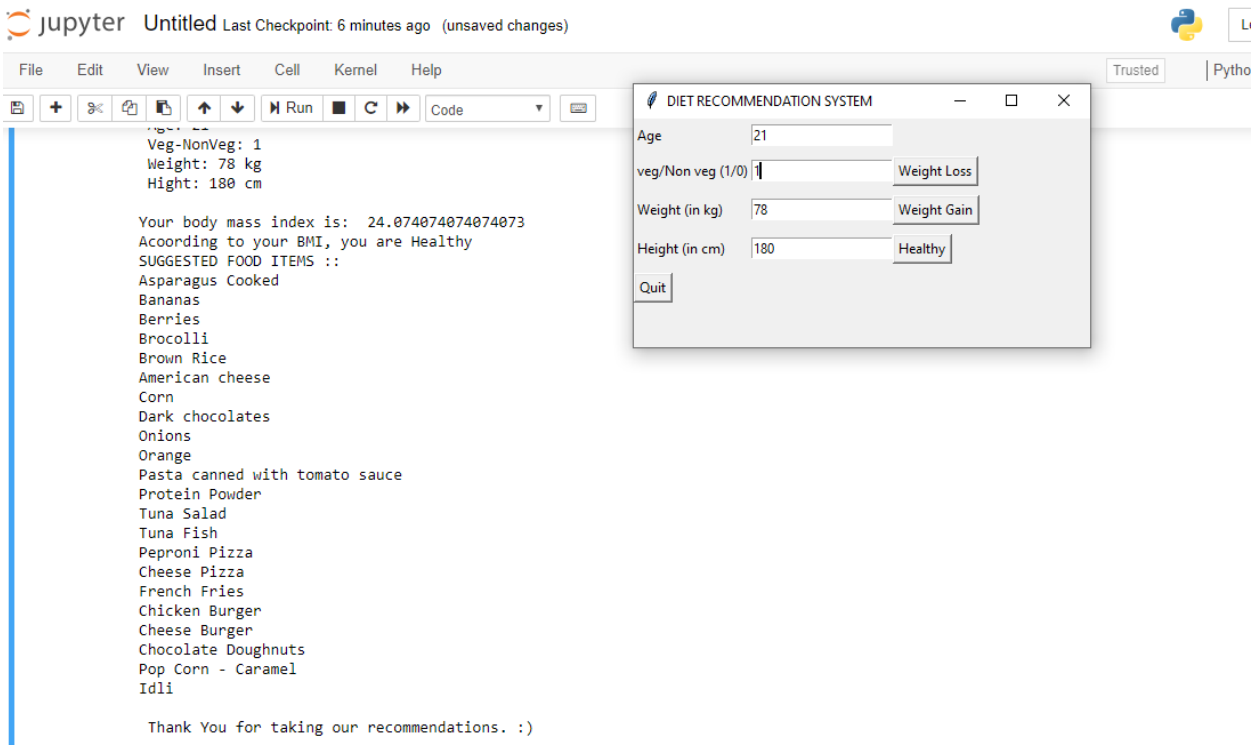
4.7 **Predicting food items for Weight Loss Diet Plan**:



4.8 **Predicting Food Items for Weight Gain Diet Plan**:



4.9 Predicting Food Items for Healthy food items:



5. IMPLEMENTATION PROCEDURE:

For training of the system, the initial process involves the segregation of food items depending upon the meal for which they are consumed i.e Breakfast, Lunch and Dinner.

The clustering of various nutrients depending upon which are essential for the weight_loss, weight_gain and healthy is performed.

After the clustering is performed, using Random Forest classifier, the nearest food items are predicted which best suited for the appropriate diet.

As part of user interface, the inputs needed from the user are Age, Height, Weight and what the purpose for which the diet is required.

Depending upon it, from the appropriate clustering, specific food items are classified and recommended to the user.

Work distribution

Module	Member
Weight Loss Diet plan	Vishal
Weight Gain Diet Plan	Izhar
Healthy Diet Plan	Bharat Kapila, Shreyas Arya

6. FUTURE SCOPE:

i. The module can be implemented as a cloud-based application.
ii. Packaged as a single entity, ready for production environment deployment.