Fit-Me

(IoT based fitness prediction system)

Submitted in complete fulfilment of the course project of

ECE3502 – IoT Domain Analyst

In

Bachelor of Technology

By

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Nevertheless, we express our gratitude towards our families and for their kind co-operation, constant support and encouragement which helped us in the completion of this project.

~ ***Our Team***
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CONTENTS:

INTRODUCTION

- Our project, Fit-Me, aims to provide a simple mechanism for people to assess their health index anywhere they want, and get nutritional info so as to have a healthier diet.
- During this COVID situation, people have been staying at home, leading to a much more sedentary lifestyle.
- Fit-Me provides a quicker solution towards height measurement and BMI calculation, thereby motivating towards a healthier lifestyle.
- This idea will save a lot of time and money of people.
- Fewer visits to the hospital would contribute towards a more economical lifestyle.

OBJECTIVE:

To develop a device system that would serve as a method to make people aware of their own well-being.

It all starts with simple weight and height calculation which helps us to height and weight of a person, can calculate their BMI, and thus provide tips towards a healthier lifestyle. A healthier lifestyle is becoming tough to get due to busy lifestyle of people, thus providing a solution by recommending them the diet which suits their personality.

COMPONENTS USED:

HARDWARE:

- ULTRASONIC SENSOR
- 16x2 LCD PANEL
- ARDUINO UNO
- JUMPER WIRES
- BREAD BOARD

SOFTWARE:

- ARDUINO
- JUPYTOR

THEORY:

HARDWARE:

- ULTRASONIC SENSORS - An ultrasonic sensor can measure distances accurately using the principle of echolocation.

- 16x2 LCD Panel- A 16x2 LCD can display 16 characters per line and there are 2 such lines. It is capable of displaying 224 different characters and symbols.

- ARDUINO UNO- Arduino Uno is a microcontroller which has 14 digital input/output pins 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack and a reset button. It contains everything needed to support the microcontroller. We just need to simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

- BREAD BOARD- A breadboard is a rectangular plastic board with a bunch of tiny holes in it (that's why the name bread board). These holes let you easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit, like this one with a battery, switch, resistor, and an LED (light-emitting diode).

SOFTWARE:

- ARDUINO IDE - The Arduino Integrated Development Environment is a cross-platform application that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

- THINGS SPEAK- ThingSpeak is an IoT analytics platform service that allows us to aggregate, visualize and analyze live data streams in the cloud. We can send data to ThingSpeak from our devices, create instant visualization of live data and send alerts.

MACHINE LEARNING:

Machine Learning algorithms are used to predict the person's diet using its Body Mass Index as a testing data. We have created two datasets where the first dataset contains the list of various foods with their features. The primary features are whether the food is under vegetarian category or non-vegetarian category, protein content, carbohydrate content, vitamins and various things. The second dataset contains how much calorie is present in a food depending on certain features such as protein, vitamin, fats, etc.

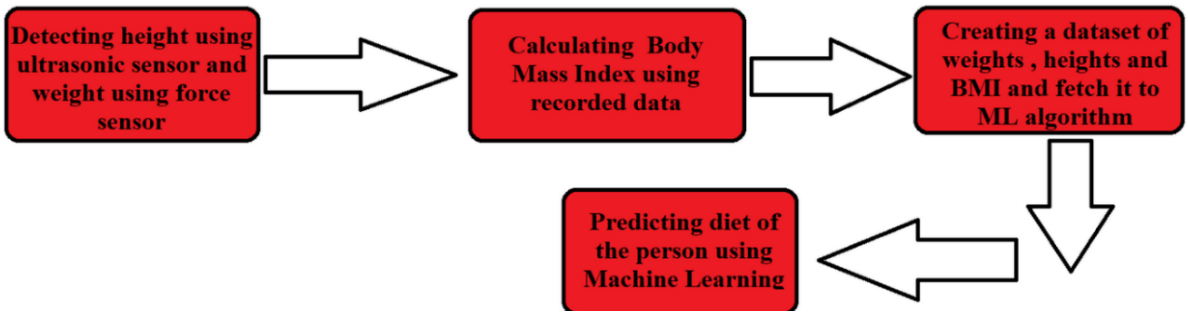
We are using both of these datasets as our training data and the testing data will be the data which we will be getting directly from the hardware device. The body mass index will be calculated from the data which is being entered and the user will be asked to enter his age and food type, i.e whether the person is a vegetarian or non-vegetarian. After calculating the body mass index, we will be proceeding further. There are five categories which we created, severely underweight, underweight, perfect, overweight and severely overweight.

After dividing into categories and taking inputs from the user we will be proceeding to our machine learning model. For this we will be using K-Means clustering for our model to predict the diet of a person according to his body mass index.

KMeans is a clustering algorithm which divides observations into k clusters. Since we can dictate the number of clusters, it can be easily used in classification where we divide data into clusters which can be equal to or more than the number of classes.

KMeans is chosen because as our data is unlabeled data and it contains various characteristics, therefore classifying will be effective when we use KMeans classifier. This is so because KMeans deals with the minimum distances between any clusters. So, for a particular person in certain criteria, the food habits should be of a particular type. For example, an overweight person requires a healthy diet which contains low fats, oil, carbohydrates. So, these features can form a cluster and using KMeans it will select the nearest clusters and the probability of getting low fat content food increases. The testing clusters will have the minimum distance from the fixed clusters, so it will be nearest to the fixed clusters. Therefore, KMeans classifier will bring up effective results.

BLOCK DIAGRAM:



WORKING PRINCIPLE:

- An ultrasonic sensor is joined in conjunction to an Arduino Uno and a 16x2 LCD Panel.
- The ultrasonic sensor is placed at head level of the person, and the subsequent distance measured between the floor of the room and the sensor is the height calculated for the person.
- Weight is also measured and placed into the system.
- Using the given data, BMI of the person is calculated, which is then used to guide the person on how to be healthy.

ARDUINO PROGRAM:

HEIGHT CALCULATION

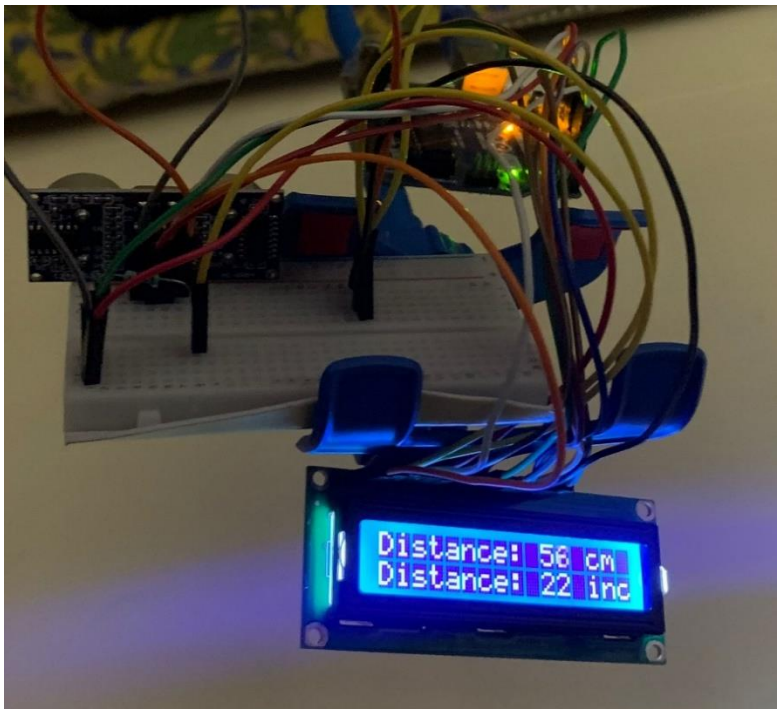
```
#include <LiquidCrystal.h>

LiquidCrystal lcd(1, 2, 4, 5, 6, 7);
const int trigPin = 9;
const int echoPin = 10;

long duration;
int distanceCm, distanceInch;

void setup() {
lcd.begin(16,2);
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
}

void loop() {
digitalWrite(trigPin, LOW);
delayMicroseconds(2);

digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

duration = pulseIn(echoPin, HIGH);
distanceCm= duration*0.034/2;
distanceInch = duration*0.0133/2;

lcd.setCursor(0,0);
lcd.print("Distance: ");
lcd.print(distanceCm);
lcd.print(" cm");
```

```
delay(10);
lcd.setCursor(0,1);
lcd.print("Distance: ");
lcd.print(distanceInch);
lcd.print(" inch");
delay(10);
}
```

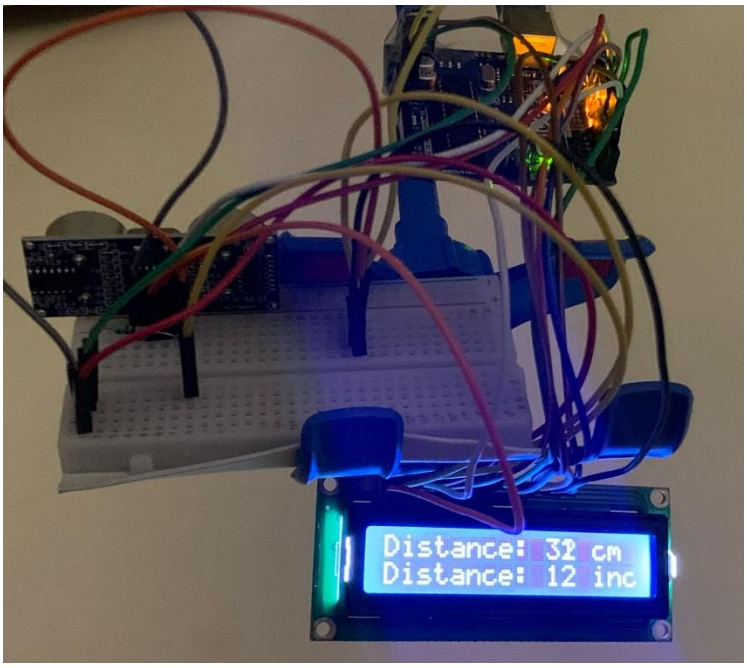
HARDWARE CIRCUIT:

Initial setup:

Total height from ground:



Measures height above the bottle:



Height of bottle= total height-height above the bottle
=22inch-12 inch = 10inch

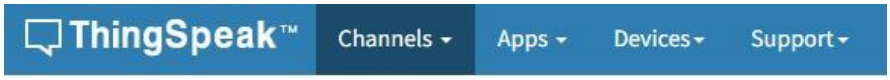
DATA SET:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Food_items	Breakfast	Lunch	Dinner	VegNovVe	Calories	Fats	Proteins	Iron	Calcium	Sodium	Potassium	Carbohydr	Fibre	VitaminD	Sugars
Asparagus Cooked	0	1	1		22	0.2	2.4	0.91	23	14	224	4.1	2	0	1.3
Avocados	1	0	0	0	160	15	2	0.55	12	7	485	8.5	6.7	0	0.7
Bananas	1	0	0	0	89	0.3	1.1	0.26	5	1	358	23	2.6	0	12
Bagels made in wheat	0	1	1	0	250	1.5	10	2.76	20	439	165	49	4.1	0	6.1
Berries	1	0	0	0	349	0.4	14	6.8	190	298	77	77	13	0	46
Brocolli	0	1	1	0	25	0.5	3.8	1.27	118	56	343	3.1	2.8	0	0.6
Brown Rice	0	1	1	0	362	2.7	7.5	1.8	33	4	268	76	3.4	0	0
Cauliflower	0	1	1	0	32	0.3	3	0.72	32	259	278	6.3	3.3	0	0
American cheese	1	0	0	0	331	24	20	0.84	497	966	363	8.3	0	0	0
Coffee	1	0	0	0	2	0	0.3	0.02	2	1	50	0.2	0	0	0
Corn	1	1	1	0	97	1.4	3.3	0.55	2	253	3.3	22	2.7	0	7.7
Dark chocolates	0	0	1	0	556	32	5.5	2.13	30	6	502	60	6.5	0	48
Grapes	1	0	0	0	93	2.1	5.6	2.63	363	9	272	17	11	0	6.3
Milk	1	0	1	0	97	6.9	3.8	0.12	169	52	178	5.2	0	0	0
Cashew Nuts	1	0	0	0	553	44	18	6.68	37	12	660	30	3.3	0	5.9
Onions	0	1	1	0	40	0.1	1.1	0.21	23	4	146	9.3	1.7	0	4.2
Orange	1	0	0	0	97	0.2	1.5	0.8	161	3	212	25	11	0	0
Pasta canned with tomat	0	1	1	0	71	0.7	2.2	0.91	13	381	192	14	0.9	0	4
Pears	1	0	0	0	57	0.1	0.4	0.18	9	1	116	15	3.1	0	9.8
Peas	0	1	1	0	81	0.4	5.4	1.47	25	5	244	14	5.7	0	5.7
Protein Powder	1	0	0	0	411	17	46	8.57	500	329	1129	19	7.1	200	5.7
Pumpkin	0	1	1	0	18	0.1	0.7	0.57	15	237	230	4.3	1.1	0	2.1
Tuna Salad	0	1	1	1	187	9.3	16	1	17	402	178	9.4	0	0	0
Tuna Fish	0	0	1	1	184	6.3	30	1.31	10	50	323	0	0	0	0
Peproni Pizza	0	0	1	0	298	14	12	2.14	146	692	199	30	1.8	0	3.2
Cheese Pizza	0	0	1	0	276	11	11	2.47	192	580	170	33	2.1	0	2.5
French Fries	0	1	1	0	289	14	3.5	0.91	17	357	545	37	3.9	0	0.3
Chicken Burger	0	1	1	1	292	15	18	0.62	13	859	315	20	1.3	0	0
Cheese Burger	0	1	1	0	256	12	13	2.78	92	660	178	25	1.4	0	0
Chicken Sandwich	0	1	1	1	257	12	15	1.32	92	605	256	23	1.2	0	5
Sugar Doughnuts	0	1	1	0	426	23	5.2	1.06	60	402	102	51	1.5	0	32

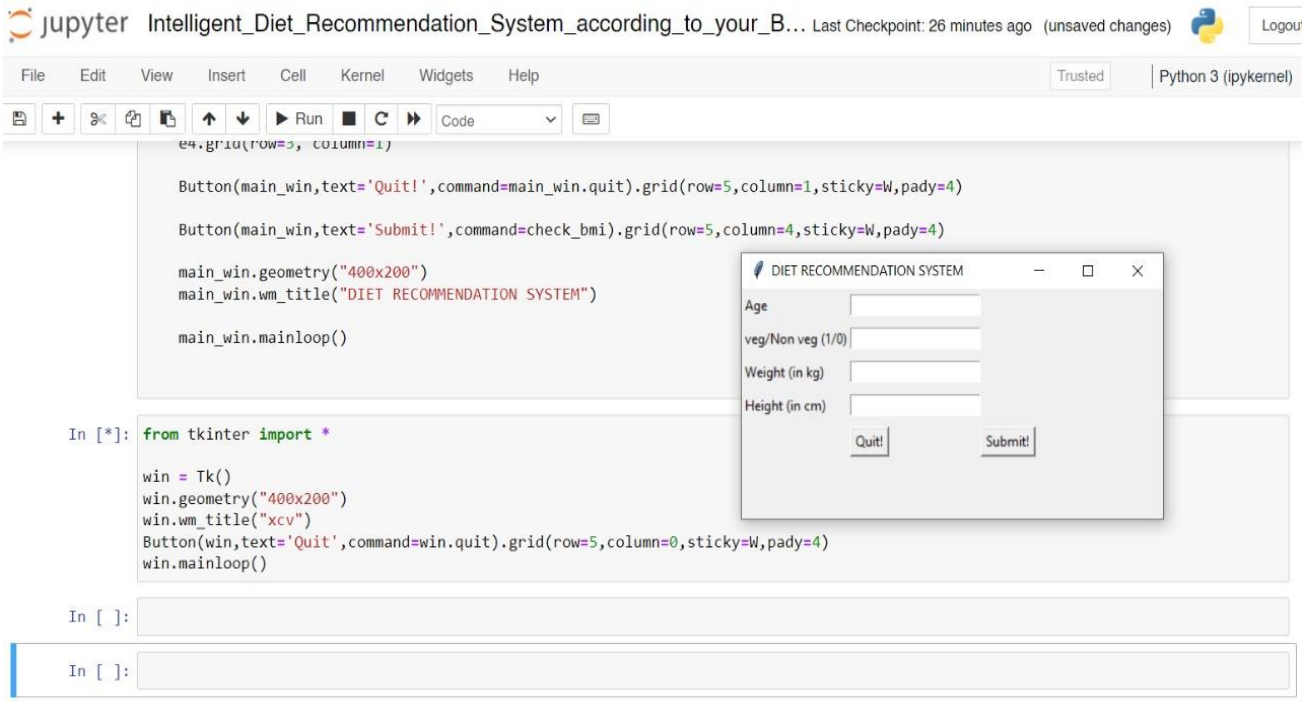
A	B	C	D	E	F	G	H	I	J	K
0Calories	1Fats (gm)	2Proteins(	3Iron(mg)	4Calcium(r	5Sodium(n	6Potassiur	7Carbohyc	8Fibre (gm	9Vitamin D	10Sugars (gm)
160	15	2	0.55	12	7	485	8.5	6.7	0	0.7
89	0.3	1.1	0.26	5	1	358	8.5	2.6	0	12
349	0.4	14	6.8	190	298	77	8.5	13	0	46
331	24	20	0.84	497	966	363	8.5	0	0	0
2	0	0.3	0.02	2	1	50	8.5	0	0	0
97	1.4	3.3	0.55	2	253	3.3	8.5	2.7	0	7.7
93	2.1	5.6	2.63	2	9	272	8.5	11	0	6.3
97	6.9	3.8	0.12	2	52	178	8.5	0	0	0
553	44	18	6.68	2	12	660	8.5	3.3	0	5.9
97	0.2	1.5	0.8	2	3	212	8.5	11	0	0
57	0.1	0.4	0.18	2	1	116	8.5	3.1	0	9.8
411	17	46	8.57	2	329	1129	8.5	7.1	200	5.7
381	1.4	2	0.8	2	286	110	8.5	2.5	0	65
429	9.5	13	2.28	2	490	241	8.5	14	0	0.5
168	3.7	4.5	8	2	94	76	8.5	0.9	0	0.1
156	1.7	5	17.2	2	207	63	8.5	2.1	0	0.74
130	1.5	2.6	3.16	2	201	117	8.5	1.1	0	0.5
16	0.2	1.2	0.47	2	42	212	8.5	0.9	0	2.63
60	4	3.1	0.08	2	70	234	8.5	0	1	7
407	6.2	4.4	3.81	2	457	51	8.5	2.9	0	55
188	7.2	4.4	24	2	522	91	8.5	2.2	0	0.24
151	2.4	9	37.4	2	438	180	8.5	1	0	1.35
579	50	21	3.71	2	1	733	8.5	13	0	4.4
22	0.3	3.1	0.5	2	5	318	8.5	1	7	2
196	15	14	1.89	2	207	152	8.5	0	88	0.4
76	0.1	1.4	0.72	2	27	230	8.5	2.5	0	5.7
87	0.1	1.9	0.31	2	240	379	8.5	2	0	0.9
45	0.2	0.7	0.2	2	1	200	8.5	0.2	0	8.4
73	1.9	10	0.04	2	34	141	8.5	0	0	3.6
40	0.9	3.2	0.88	2	1	92	8.5	2.6	0	0

OUTPUT SCREENSHOTS:

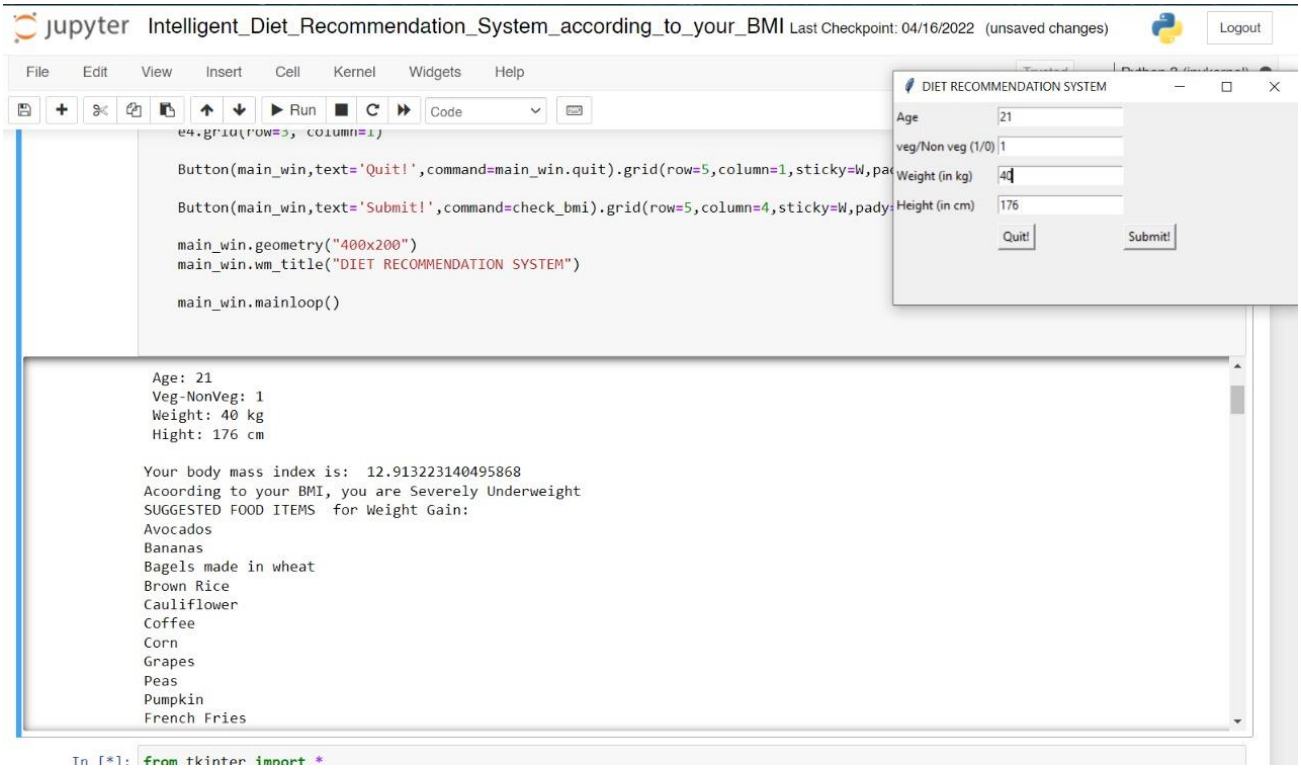
ThingSpeak Visuslization:



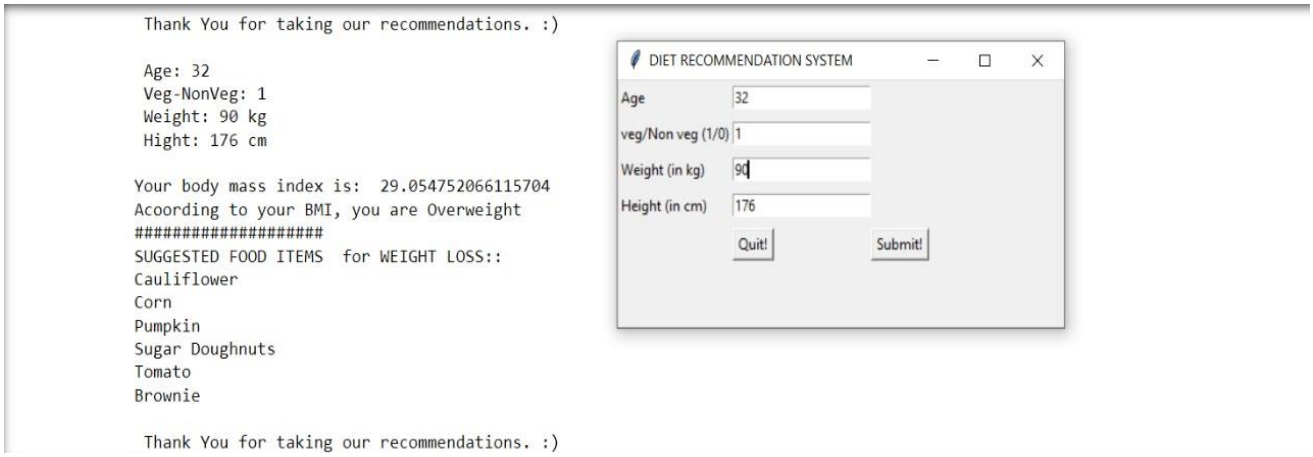
Machine learning prediction output using Jupyter Notebook:



Here, in order to calculate the BMI and get the predicted diet according to the BMI of that person, we need to enter the age, weight, height and the preference of that person whether they want veg diet or non-veg diet**.**



Taking the age as 21, weight-40 kg, height-176 cm and preference as veg-diet then the BMI will be obtained as 12.91 and it displays that the person is severely underweight and the suggest food has been displayed according to the preference and BMI of that person.



For overweight person these are the recommended diet according to the veg-diet.

INFERENCE:

Hence, we have successfully obtained the desired predicted diet for the person according to their height and weight which we obtained using the Arduino and used it to calculate the BMI of that person. Then we obtained the diet of that person according to the BMI and the diet preference of that person whether he/she wants veg/non-veg diet.

APPLICATIONS:

- Health monitoring system in village areas where doctor accessibility is difficult.
- Self-checkup clinics (automated AI based).
- AI nutritionist for the elderly.

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