

**DWIT COLLEGE**  
**DEERWALK INSTITUTE OF TECHNOLOGY**  
**Tribhuvan University**  
**Institute of Science and Technology**



**FOOD RECOMMENDATION SYSTEM BASED ON  
CONTENT FILTERING ALGORITHM**

**A PROJECT REPORT**

Submitted to  
Department of Computer Science and Information Technology  
DWIT College

*In partial fulfillment of the requirements for the Bachelor's Degree in Computer  
Science and Information Technology*

Submitted by  
Kundan Shumsher Rana  
August, 2016

**DWIT College**  
**DEERWALK INSTITUTE OF TECHNOLOGY**  
**Tribhuvan University**

**SUPERVISOR'S RECOMENDATION**

I hereby recommend that this project prepared under my supervision by KUNDAN SHUMSHER RANA entitled “**FOOD RECOMMENDATION SYSTEM BASED ON CONTENT FILTERING ALGORITHM**” in partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Information Technology be processed for the evaluation.

.....

Rituraj Lamsal  
Lecturer  
Deerwalk Institute of Technology  
DWIT College

**DWIT College**  
**DEERWALK INSTITUTE OF TECHNOLOGY**  
**Tribhuvan University**

**LETTER OF APPROVAL**

This is to certify that this project prepared by KUNDAN SHUMSHER RANA entitled “FOOD RECOMMENDATION SYSTEM USING CONTENT BASED FILTERING” in partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Information Technology has been well studied. In our opinion it is satisfactory in the scope and quality as a project for the required degree.

..... Rituraj Lamsal [Supervisor] Lecturer DWIT College	..... Hitesh Karki Chief Academic Officer DWIT College
..... Jagdish Bhatta [External Examiner] IOST, Tribhuvan University	..... Sarbin Sayami [Internal Examiner] Assistant Professor IOST, Tribhuvan University

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Kundan Shumsher Rana

TU Exam Roll no: 1803/069

## **STUDENT'S DECLARATION**

I hereby declare that I am the only author of this work and that no sources other than the listed here have been used in this work.

.....

Kundan Shumsher Rana

Date:

## **ABSTRACT**

The project entitled “Food Recommendation System based on Content Based Filtering Algorithm” recommends a food item list and displays the result depending on the nutritional value of the food item. Here, a primary food ingredients is selected. If the food items that are in the database have either ingredient as a main ingredient, then the food items are listed in order of their nutritional value. (WHO, 2010.)

The project analyzes the food items in database and their main ingredients. When the ingredient that the user queried about is found, in the database of the food items present, they are sorted and filtered according to the nutritional value they contain. The amount of calorie that the food contains is taken into consideration here. The suggestion to the user is based on the amount of calories present in the food item. The recommendation is done based on Content Based Filtering Algorithm.

**Keywords:** Food Recommendation, Nutrition, Nutritional Value in Food, Content Based Filtering Algorithm

# TABLE OF CONTENTS

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 Testing.....	14
4.2.1 Unit testing.....	14
CHAPTER 5: MAINTENANCE.....	16



5.1 Corrective Maintenance .....	16
5.2 Adaptive Maintenance .....	16
CHAPTER 6: CONCLUSION .....	17
6.1 Conclusion .....	17
6.2 Recommendation .....	17
References.....	18
Bibliography .....	19

## LIST OF FIGURES

Figure 1 - Use Case Diagram.....	8
Figure 2 - Sequence Diagram of the application .....	12
Figure 3 - State Diagram of Application.....	13

## **CHAPTER 1: INTRODUCTION**

### **1.1 Background**

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. The World Health Organization is predicting that the number of obese adults worldwide will reach 2.5 billion by 2018 and the issue is attracting increased attention. (WHO, 2010.)

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.

The domain of food centered here are milk and fish. These are taken as the main ingredients. Almost all of the foods, that include either of these as a main ingredient is taken into consideration. Other factors include the nutritional breakdown, as well as the

Food recommendation system using content based filtering algorithm

cultural and social factors. Add this to the sheer number of foods and the fact that eating often happens in groups, the complexity of the challenge is clear.

This recipe recommendation application can help the user to find their favorite food and its nutritional value. This is done by searching the foods that contain one of the prime ingredients and shows their nutritional value.

## **1.2 Objectives**

The goal of the application is to provide a platform where users find their favorite food and its nutritional value. This is useful for anyone who is health conscious or wants to lose weight.

This application can be used as a standalone application or it can also be used as a part of a more sophisticated application.

## **1.3 Scope**

The application can help people who like to eat milk or fish. The application is targeted towards a local audience, for now, and as of present it can only be used as a web application that recommends food based in their nutritional value.

## **1.4 Limitation**

- Only foods containing milk or fish can be searched.
- Only displays the nutritional value of the food.
- Does not contain a wide variety of food but only the popular ones in Kathmandu.

## 1.5 Report Outline

Preliminary	<ul style="list-style-type: none"><li>• Title Page</li><li>• Supervisor's Recommendation</li><li>• Letter of Approval</li><li>• Acknowledgement</li><li>• Abstract</li><li>• Table of Contents</li><li>• List of figures and Tables</li></ul>
Introduction	<ul style="list-style-type: none"><li>• Background of Research</li><li>• Objective</li><li>• Scope</li><li>• Limitation</li></ul>
Literature Review	<ul style="list-style-type: none"><li>• Food Recommendation System</li><li>• Content Based Filtering Algorithm</li></ul>
System Development	<ul style="list-style-type: none"><li>• Data collection</li><li>• Data Processing</li><li>• Algorithm Used</li></ul>
Result	<ul style="list-style-type: none"><li>• Test Result Summary</li></ul>
Conclusion	<ul style="list-style-type: none"><li>• User can search the desired food</li></ul>

## **CHAPTER 2: REQUIREMENT AND FEASIBILITY ANALYSIS**

### **2.1 Literature Review**

Chun-Yuen Teng, Yu-Ru Lin and Lada A Adamic wrote a paper titled “Recipe Recommendation using ingredient network” which tells that the user’s preference of ingredient, cooking method and food preferences greatly affect a person’s lifestyle and their health. They tell how each ingredient works in many ways to make a person healthy or dull. Each ingredient present in the food a person eats gives off different type of nutrition to a person. They constructed networks that capture the relationship between ingredients. The complement network that they worked on captures which ingredients frequently come together. The network constituted of two large communities, namely savory and sweet. The substitute network, derived from user-generated suggestions for modifications, can be decomposed into many communities of functionally equivalent ingredients, and captures users’ preference for healthier variants of a recipe. The experiments reveal that recipe ratings can be well predicted with features derived from combinations of ingredient networks and nutrition information. They found that foods do not have a large diversity of ingredients. When a main ingredient is taken, the method of preparation depends upon the person and the other ingredients used. (Chun-Yuen Teng, 2012)

According to a paper, co-written by Jeremy Cohen, Robert Sami, Aaron Schild and Spencer Tank titled “Recipe Recommendation”, they found that the ingredients used need to be

Food recommendation system using content based filtering algorithm

well established for their nutritional value, i.e., if the person knows beforehand what nutritional values an ingredient contains then the person can prepare the food accordingly and select other ingredients as required. (Jeremy Cohen, 2014)

### **2.1.1 Content based filtering algorithm**

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 user.

### **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.

### **2.1.3 Related works**

Recommender system has been widely used in recent days, in the field of food recommendation.

Choose MyPlate: It illustrates the five food groups that are the building blocks for a healthy diet using familiar images – a place setting for meal. This helps users to think before eating and take a minute to contemplate about what is in the plate in front by showing what the food is what nutritional values it contains.

Healthy Food Recommendation & Lists: If the user is not sure what to add to their list of foods for a healthy diet, want to change their current diet and need nutritional guidelines for a specific condition, diet, or lifestyle, this site is useful. With healthy foods that match the user's profile, their quick-start food lists can get users started right away with tracking and analyzing what to eat. If users already started a list of "My Foods", they can add one or more quick-start lists to their existing list.

Dietary Guidelines: The Dietary Guidelines is a popular go-to source for nutrition advice. Published for public health professionals, each edition of the Dietary Guidelines reflects the current body of nutrition science. These recommendations help people make healthy food and beverage choices and serve as the foundation for vital nutrition policies and programs.



## **2.2 Requirement Analysis**

A requirement analysis was done on the product and the following data was obtained:

### **2.2.1 Functional requirement**

The user can search for the main ingredient needed.

Currently, only the main ingredients milk and fish are available. The list of foods will appear and the user can select a food item. They will be guided to another page where can see the nutritional value of the food.

### **2.2.2 Non-functional requirement**

The user must enter a food item. In this version, only fish and milk are available. So, the user enters “fish”. This will show a result of the foods that contain fish as a main ingredient. Currently, there is no login function to maintain a user preference.

## Food recommendation system using content based filtering algorithm

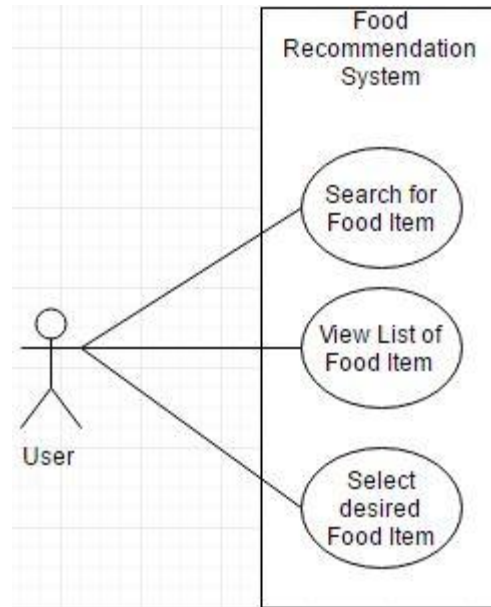


Figure 1 - Use Case Diagram

As shown in Figure 1, the user can search for the desired food item. The user can then view a list of related food item and select a desired food item to see its nutritional value.

The user receives the food item list based on the nutritional value of calories.

### **2.3 Feasibility Analysis**

The following result was obtained while performing a feasibility analysis:

#### **2.3.1 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 their nutritional value.

### **2.3.2 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, Flask 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.

### **2.3.3 Schedule feasibility**

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

## **CHAPTER 3: SYSTEM DEVELOPMENT**

### **3.1 Methodology and Algorithm**

Seeing that the requirements of the application were clear, the waterfall model was used to develop the application. The detailed methodology used to develop the application are described in the following subsections.

#### **3.1.1. Data collection**

The list of food and their nutritional value were collected using extracted from two websites, [www.livestrong.com](http://www.livestrong.com), and [www.nutritiondata.self.com](http://www.nutritiondata.self.com).

The data collected was mainly of the foods that contain milk or fish as the main ingredient. Since both are healthy foods, the other ingredients that are added to them during the food preparation period are the contributors that increase the values of other nutritional values like calories.

#### **3.1.2 Data processing**

The available data was divided into training set and test data. 80% of the data was used for the training set.

### 3.1.3 Algorithm used

Content Based Filtering Algorithm: In a content-based recommender system, keywords or attributes are used to describe items.

Calculate the weight of each feature, namely Calories, that has the lowest value. This step is in order to make an accurate list of food items. If the category  $i$  has the lowest value  $C_j$ , but it has many content's features  $j$  in specific category  $i$ , the application needs to compute the weight  $W_i$  of each feature content value  $C_i$  within that category. The equation given below is adopted from below.

$$W_i = \frac{C_i * \sum_{j=0}^n C_j}{n}$$

After computing the weight of each feature content, the highest weight is seen as having the lowest value. Only the food items which have the lowest calories value is shown in the list to the user. The list is sorted in value of the calories from lowest to highest.

## 3.2 System Analysis

For the system analysis of this application, following three methods have been used:

- Sequence Diagram
- State Diagram

### 3.2.1 Sequence diagram

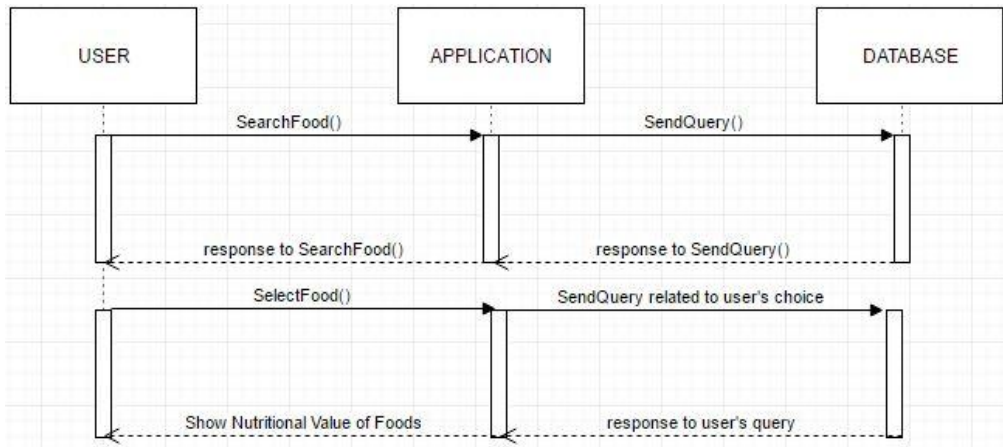


Figure 2 - Sequence Diagram of the application

As in Figure 2, the user inputs a food item query in the application. The list of food with the food item query with the main ingredient is shown. The user selects the desired food and this will guide the user to a new page where all of the nutritional value of the food will be shown.

### 3.2.2 State diagram

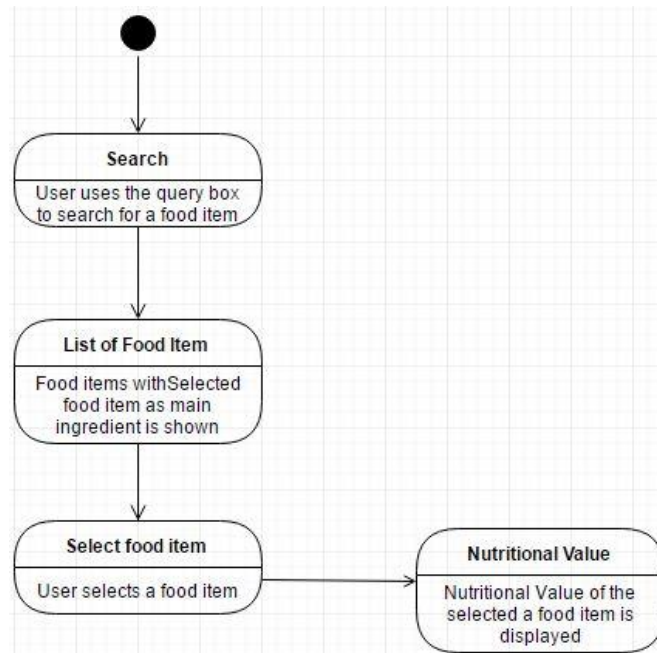


Figure 3 - State Diagram of Application

The Figure 3 explain the states of the application. When the user opens the application, they can make a search for the food item desired. Then they are directed to a page where there is a list of food items where the searched ingredient is the main ingredient. They select a food item. Now, the nutritional value of the food is displayed.

## **CHAPTER 4: IMPLEMENTATION AND TESTING**

### **4.1 Implementation**

#### **4.1.1 Tools used**

The application is based on Flask framework. It uses python programming language in back-end and JavaScript in front-end. MYSQL was used as DBMS for the application. The algorithms were implemented in python.

### **4.2 Testing**

#### **4.2.1 Unit testing**

Unit testing was performed to test correctness of various modules.

Test Case 1:

Title: Enter an ingredient

Precondition: The landing page of the application is open in the browser.

Test Step(s):

In the search bar, the user enters an ingredient. Here, the ingredients are currently milk or fish.

Expected Output:

A list of food items is shown where the entered ingredient is the main ingredient.



## Food recommendation system using content based filtering algorithm

Test Case 2:

Title: Click on a food item

Precondition: The user has selected an ingredient.

Test Step(s):

The user selects a food item with the selected ingredient as the main ingredient. In this case, milk or fish.

Expected Output:

The user is directed to a page where the nutritional value of the food item is shown.

## **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.

## **CHAPTER 6: CONCLUSION**

### **6.1 Conclusion**

The project Food Recommendation System was successfully completed by using Content Based Filtering 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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