Implementation on Smart Food Recipe Recommendation Application Using Content-Based Filtering Algorithm

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ABSTRACT: In general, people like to cook but they have no idea on what to cook and how to cook. Furthermore, they also wish to know certain recipes that suit to their preference. There are many cooking recipe websites but most of them do not provide suggestions for the user based on user's food preferences. Current recipe suggestions developed by some researchers are mainly based on the collective interests, demographic information, and ingredients content. With respect to the problem mentioned previously, a content based mobile recipe application is proposed and tested in this paper. The main objective of this proposed application is to suggest a user preferred recipe using content-based filtering algorithm. In this application user will be suggested the cuisines based on the ingredients user is having at the moment., It will suggest user what to cook today. For example, Suppose the user is having some XYZ ingredients based on those ingredients the application will suggest a recipe to prepare or cook and in the second scenario if the user is not having sufficient ingredients in that case the application will suggest the ingredients as well to purchase those missing ingredients.

KEYWORDS: Content based filtering algorithm, data mining, Android Phone, Dataset, Web Server, Ingredients, Searching Recipes.

I. INTRODUCTION

Nowadays, people are faced with a limited selection of meals and are often constrained in searching for recipes (i.e. having full working day). Preparing meals may requires people to search, think, prepare, and even learn new recipes, but still poses a risk of frustrating the family members, spouse, or themselves. This problem is caused by the new recipe which can vary from the preferred set of meals and does not fit the daily habits. Additionally, certain people would wish for different cooking recipe(s) that provide variation, but still suits their preferences. In addition, the sense of taste for every person is distinctive from each other. Not every person prefers to take similar kind of meal. A person may prefer meal x above others, while another person may prefer meal y instead. Moreover, every person has their own meal preference(s) such as person a likes to eat spicy food while person B likes to eat sweet food. However, recommending a new or different recipe which does not diverge from a person's preferred taste and habit are the main issue. Therefore, to recommend the right recipe which is based on a personalized preference(s) would be very useful and commendable.

Currently, many cooking recipe websites and mobile recipe applications have been launched that allow people to search for recipes. Various recipes can be found from these mobile applications, which sometimes include media instructions. However, they cannot provide a personalized recipe recommendation based on the user's preference that is availability of those ingredients. Despite plenty of recipes being provided by the cooking application, the application user always has to spend additional time to browse through recipes that they are not particularly interested in, making the user frustrated and eventually, lose interest. They need an easy way to get their preferred recipe(s) as soon as possible and as accurate as possible, with only available user preferred ingredients and then next suggest second preferred recipes with missing ingredients.

II. PROPOSED SYSTEM

Methodology:

One of the most frustrating things about planning a last minute meal? It's almost impossible to find a recipe online that actually includes things you already have in your kitchen. Whether it's the end of the month and you're waiting on a paycheck, you're surprised by company, or you just don't feel like going to the grocery store, sometimes, you just need to be able to whip something delicious together without leaving the house — and somehow, every recipe on Pinterest includes at least two ingredients you've never even heard Fortunately, that's where smart recipe recommendation system comes in, and if you're not familiar with the site, there's a good chance it's about to change your life. As long as you know what you have, you can find something to make… and it takes practically no time at all.

So where do you get started? There are two ways to fast track your dinner.

SEARCHING BY INGREDIENTS

If you want to search by ingredients, head on over to the left side of the site. You can either check which ingredients you have by category, or type them in yourself. Make sure you include everything, especially which spices you have.

As you're entering ingredients, smart recipe recommendation system is scouring the internet for recipes from several different sites, including Food.com and Allrecipes.com. When it's done, you'll have a list of hundreds (if not thousands) of meals, side dishes, snacks, and desserts you can choose from.

SEARCHING BY RECIPE

If you're craving something in particular and want to know what you can make with what you have on hand already, this might be the way to go. Once you're on the smart recipe recommendation system android application, enter the kind of recipe you're looking for in the search bar on the right, and then check off your ingredients. If you want to make mac and cheese from scratch, just type in "mac and cheese" and then click on which ingredients you have handy. Then, the site will show you mac and cheese recipes that only include what you've got in your house.

And if you have specific dietary needs or are looking for vegan or vegetarian recipes only, you can sort your results that way by checking out the menu at the top of your screen once the recipes begin showing up. You can also choose to only see a certain type of cuisine or meal type, too. And if you love smart recipe recommendation system, you can also sign account or create an account on the application to save your ingredients for next time.

Honestly, sometimes ordering in is the way to go … but why bothers if you can make something yummy with what's already in your fridge?

Our Android application makes use of Content Based Filtering approach to make recommendations. Initial recipe recommendations are based on available items ingredients selected and therefore after the recommending using missed ingredients of user preference and user rates recipes then recommendations will be made by computing similarities between different users based on their preference data. For each of the users, user profiles are created based on the history of recipes rated.

To compute item based similarity for recipes based on preferences by the user, To compute user based similarity based on preferences for the recipes.Recommendation system are widely used on e-commerce, social networking, and entertainment web sites such as Amazon.com, Facebook and Levis.com. Recommendation systems provide recommendations for products, services, andInformation that might have the best chance to attract people. Recommendation systems applies knowledge discovery techniques to analyze the user preference based on the interaction of user , which helps the user deal with a lot of information while reducing the searching time to get the information of interest. Recommendation systems must obtain input from the user to collect the required data needed to compute for a specific recommendation. Generally, there are two types of recommender algorithms suitable to solve the underlying problem: CBFA and collaborative filtering algorithm. Other recommendation algorithms include then

demographic filtering algorithm which is not explicitlysuitable for the considered problem but still provides useful insights.

A. Content-Based Filtering Algorithm (CBFA)

CBFA is an algorithm that performs item recommendation based on the content of the item and the user's preference. It finds the similarities between the features of an item that the user likes and then recommends another item which has the common features of the item that the user likes. For example, the features of a movie such as the actor, director, and genre of the movie are needed in order to make a suitable movie recommendation. Some people only like horror movies, while others may prefer to watch a movie with their favorite actors. Amazon has used this content-based profiling to provide the "favorite" feature to indicate a user's preference on categories of items. In addition, CBFA also tries to recommend items that are similar to those that the user had liked in the past [6] [7]. For example, the system would recommend movies in the same genre (horror), for someone who has watched and enjoyed many horror movies. However, in order to make a precise recommendation, the system would need sufficient information such as description on types of items that a particular user is interested in and the history of user's interaction with the system to collect and populate the user's preference(s). The system can explicitly collect relevant feedback such as ratings and comments given by the user or implicitly by observing user's interaction such as the categories that the user has viewed [7] [5]. An example of such a recommendation system is the system proposed in [8], where food is recommended based on the eating preference in the patient care facility.

B. Collaborative Filtering Algorithm

The collaborative filtering algorithm uses the preferences of other users with similar interests to predict another user's interest. Unlike content-based filtering, collaborative filtering can recommend an item by combining the opinions of other like-minded individuals without understanding what the item
is about [2] [3]. For example, person X likes to watch movie A, movie B and movie C, while other users like to watch movie A, movie B, movie C and movie D. As such, the system will recommend movie D to this person X because of the interest and taste in movies that they share. Through this technique, users can discover new items that are within their interest but were previously unknown. The opinions of users can be obtained explicitly and implicitly through the rating given by users [9] [6] [7], which can be used to further improve the technique. Such systems exist for online food store recommendation as was [10], where users are aggregated based on group labels as well as their purchasing habits.

C. Demographic Filtering Algorithm

The demographic filtering algorithm uses data such as age, gender, education and income to categorize users group. For example, people of high level of education, people of below 18 years old and people of high salary can be grouped into different categories. If a customer has a high level of education, results will be filtered based on the preference of high level of education. The user's need for a product is strongly related to these variables. For example, age group such as teenagers tends to like trendy clothing, whereas age group such as high salary will tend to like branded and high quality products.

D. Comparative Analysis Between The Filtering Algorithms

Each of the filtering algorithms have their own strengths and drawbacks. One of the advantages of CBFA is user independence. CBFA solely depends on ratings provided by the active user to learn the user's preference. However, a collaborative filtering algorithm depends on other like-minded users to rate the same item to gather the users' preferences. Moreover, CBFA does not suffer from the "cold-start" problem for new items where interaction with the user isrequired beforehand. The collaborative filtering algorithm will have this problem because the new item would cease be recommended only if the new item is rated by a number of users. If the user feedback is nonexistent, collaborative filtering algorithm will have difficulty finding similar users.

One of the drawbacks of CBFA is the ability to provide recommendation would negatively be affected if there is not enough data to distinguish the item that the user likes and/or dislikes [5]. On the other hand, the disadvantage of demographic filtering algorithm is mainly due to the scarcity of data from users as it requires sensitive data that can infringe user's privacy. Furthermore, recipe recommendation application is based on user preference which does not

pertainto these variables, so the demographic filtering algorithm is unsuitable to handle the underlying problem. After reviewing the advantages and drawbacks of recommendation systems, content-based filtering system is chosen to provide recipe recommendations to users. This is because content-based filtering does not have the "cold-start" problem and it solely depends on the active user in order to obtain their preference(s) [5]. Besides that, it is easy for a recipe recommendation system to gather and adapt to the user's preferences, which can be tracked through the user's search history. This is reasonable because users do not search for a recipe that they dislikes; may simply looks for recipes that they like the most. The drawbacks of the content-based filtering can be solved after some input from the user is obtained, collected, and employed into the proposed mobile recipe application

III.PROJECT FLOW

A. System Development and Framework

The mobile recipe android application was developed using android studio and Android SDK was used for the development environment and user interface, respectively. Rapid API and Google search API use to explore all types of recipe information and fetch respective kind of data to show only those recipes which user have sufficient ingredients also when user search same kind of data then application store into our server database for saving API hits. My SQL and SQLite database were used to store all the information related to this application. This is a client server application,xampp server was used at the server side. PHP (Hyper-text Preprocessing) was used for database accessing. JSON was used as the data-interchange between the client and server side. Besides the suggestion function, this application also includes some other functions not covered in this paper as the main focus is on the suggestion function using the CBFA.

Basically, the proposed mobile recipe recommendation application consistsof three components, which are the user interface, databases and the recommender module. The user interface translates the stored information in the database to a human-readable language for the users and receives inputs from the users. The database consists of three parts; the recipe ingredients information repository, the user profile repository, and the user's log repository. The recipe information repository and user profile repository basically stored related information for the recipes and the users, respectively. The user's log repository keeps track of every detail of every user action within the system. InAddition, the user's log repository is the backbone of the CBFA where its data is used to determine the appropriate recipe to recommend.

B. Content-Based Filtering Algorithm:

The CBFA is founded based on the content of the recipes ingredients and the user's preference on these ingredients. It finds the best recipe which made with very less time based on those ingredients that user currently available. Then content based algorithm find second scenario, if the user is not having sufficient ingredients in that case the application will suggest the ingredients as well to purchase those missing ingredients based on those suggest second preferred recipe which user possible to make also provide support to user make recipe without any interrupt.

This kind filtering based on contents of our dataset application gives a proper listing of recipe which user more understanble and consider all possible things first and then giving proper listing of recipes. Every search made by a user is recorded and stored in the user's log repository. The main requirement to be considered as a candidate to be recommended is that the user must first view at least one recipe. For users who have never viewed any recipe, but if wants to request for suggestions, users can

Choose a suggestion based on his/her criteria instead. The user searching history which is stored in the user's log repository is used for computing and identifying his/her preference(s). This is because it is rare for a user to accidently perform a search or search for an undesirable recipe. Essentially, there are three major steps in the recipe recommendation application using CBFA: data collection, the computation of the weight of each featured content, and the recipe recommendation. In the end, the system will recommend recipes which have the highest weight of the common feature.

1) Data Collection

At this stage, data of all possible ingredients which required to make any recipe consider all this then make a proper data collection of ingredients, data is collected from the user's log repository and the recipe information repository. The number of views by the particular user in each category is calculated. Then, the category that has the highest number of views is selected.

2) Recommend Recipe

After computing the weight of each featured content, only the recipes which have the highest weight of common featured content suggested the cuisines based on the ingredients user is having at the moment. The application is fully based on Artificial intelligence, it will suggest user what to cook today.
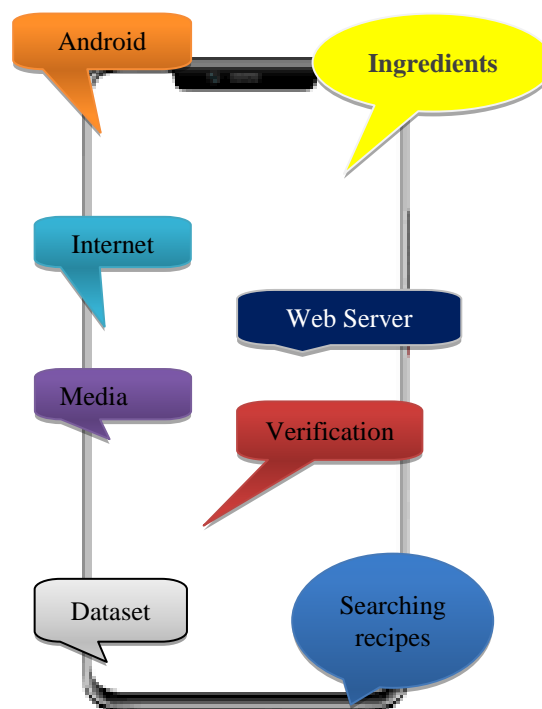
Organization of the project

Fig: Organization of the project

You can search for recipes based on what you already have on hand.

- It's easy to look up recipes online, but if you need something to cook tonight, it's hard to find something that includes the ingredients you already have at home.
- Fortunately, that's where Smart recipe recommendation system comes in — an android application that allows you to search for recipes based on what you already have in your fridge and pantry.
- By entering in your ingredients or searching by recipe type, it's easy to find something that sounds delicious, no trip to the grocery store required.
- If you're not having any ingredients in your fried or pantry then you can purchase online as well with just one click with help of application.

If you're not a good cook and you're not having any idea related to cooking, you can watch tutorial as well based only on ingredients in tutorial videos.

IV.RESULT

Application Screenshots:
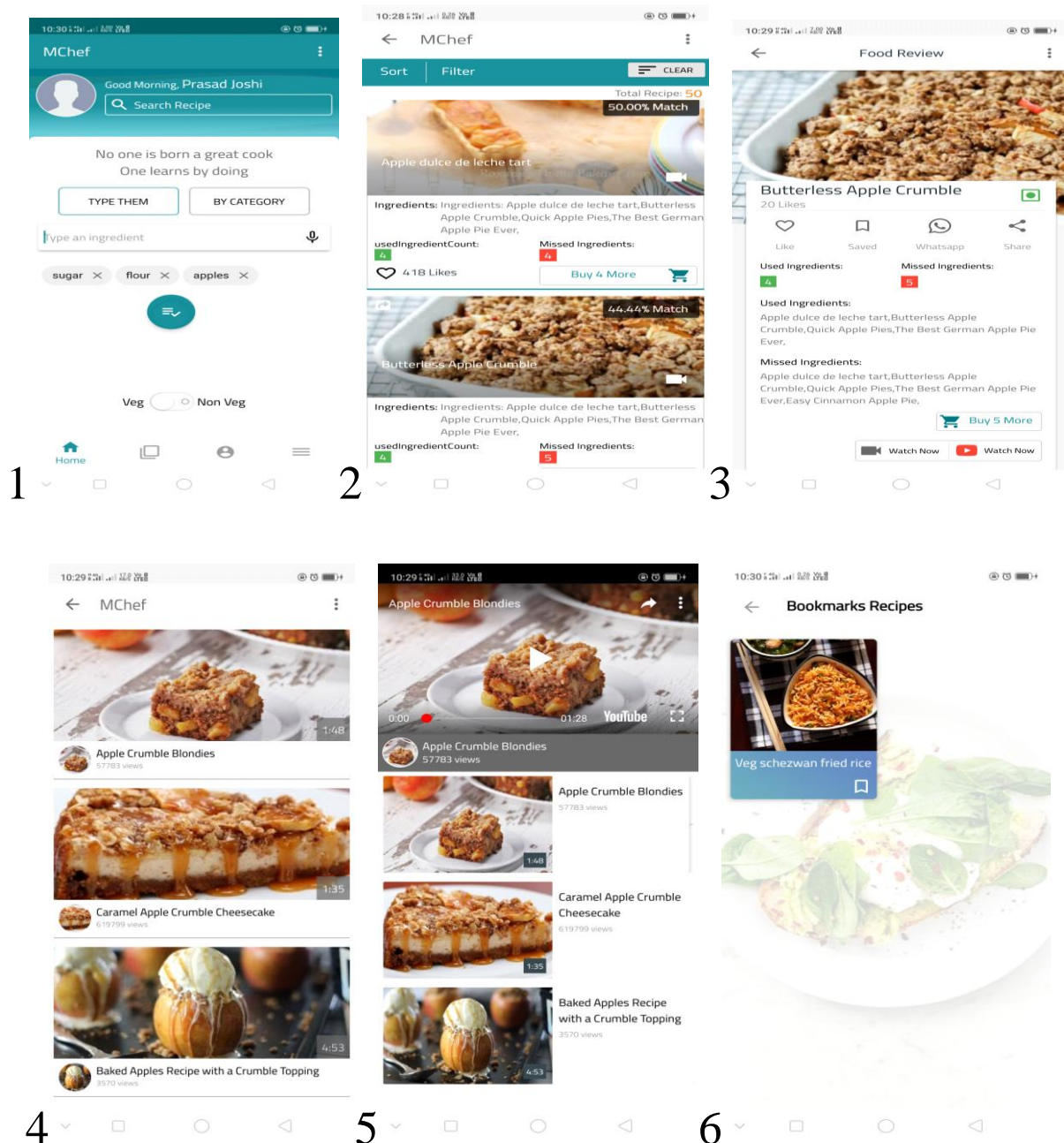
In the first screenshot, as we can see, its the first screen after login. In this we can search the recipe or ingredients by typing their name or by Category. We have an option to toggle between Veg and Non-Veg too. Thus we can search any ingredient or recipe quite efficiently.

In the next screen we get the result for our search. We get a list of recipies that can be made using the ingredients that we had searched, showing the match percentage, which is the percentage of number of ingredients matched i.e. what we aleady have. It shows us what ingredients are missing for the respective dish to be cooked and as a plus we have a buy option for the same (Missing Ingredients).

V. CONCLUSION

This application allows the user to select the ingredients he or she wants and view recipes that contain those ingredients. These ingredients can be sorted and filtered to the user's convenience. The user can also view recipes directly and select the one to cook. Recipes can be also added by the user along with new ingredients. The recipes also show nutritional facts that can help the user make a better choice. Thus giving the user complete control over his or her food choices and preparation. This application was developed to solve one of the problems most people have, what could be made from the available ingredients. The application solves this and many other problems while also providing the user with nutritional knowledge about their food.This application can be used by a broad range of users which may include parentstrying to cook new recipe for kids, people who are fond of desserts, restaurants ownertrying to add new item to their menu and for regular cooking. It will help to make the livesof people simpler.

REFERENCES

[1]. M.B. Vivek, N. Manju and M.B. Vijay "Machine Learning Based Food Recipe Recommendation System", Information Science and Engineering, Sri Jayachamarajendra College of Engineering,Mysore, India.

[2]. Teh Lee Cheng, UmiKalsomYusof, Mohd Nor Akmal Khalid , "*Content-Based Filtering Algorithm for Mobile Recipe Application*" in School of Computer Sciences Universiti Sains MalaysiaUSM, 11800 Georgetown, Pulau Pinang, Malaysia.

[3] Adomavicius G, Tuzhilin A (2005) Toward the next generation of recommender systems: a survey of the state-of-the-art and possible extensions. IEEE Trans Knowl Data Eng 17(6), 734–749.

[4]. Introduction to recommender systems handbook, Recommender systems handbook,Online ISBN 978-0-387-85820-3, Springer US (2011)

[5]. Karan Choudhari1, Shreetan Naik2, Mayur Bhavsar3, SnehalAhire "*Content-Based Filtering Algorithm for Mobile Recipe Application,*" International Journal of Technology And Engineering System(IJTES), vol. 4, no. 2, Feb 2017.

[6]. Y. van Pinxteren, G. Geleijnse, and P. Kamsteeg, "A user-centered approach to define a content-based recipe similarity measure," 2010.

[7]. Q. Li and B. M. Kim, "Constructing user profiles for collaborative recommender system," in Advanced Web Technologies and Applications. Springer, 2004, pp. 100–110.

[8]. J. B. Schafer, D. Frankowski, J. Herlocker, and S. Sen, "Collaborative filtering recommender systems," in The adaptive web. Springer, 2007, pp. 291–324.

[9]. M. J. Pazzani and D. Billsus, "Content-based recommendation systems," in The adaptive web. Springer, 2007, pp. 325–341.

[10]. P. Lops, M. De Gemmis, and G. Semeraro, "Content-based recommender systems: State of the art and trends," in Recommender systems handbook. Springer, 2011, pp. 73–105.

[11]. A. Rajaraman and J. D. Ullman, Mining of massive datasets. Cambridge University Press, 2011. [7] C. Ramadoss, "Recipe recommendation."

[12]. T. De Pessemier, S. Dooms, and L. Martens, "A food recommender for patients in a care facility," in Proceedings of the 7th ACM conference on Recommender systems. ACM, 2013, pp. 209–212.

[13]. N. Good, J. B. Schafer, J. A. Konstan, A. Borchers, B. Sarwar, J. Herlocker, and J. Riedl, "Combining collaborative filtering with personal agents for better recommendations," in AAAI/IAAI, 1999, pp. 439–446.

[14] M. Svensson, J. Laaksolahti, K. Höök, and A. Waern, "A recipe based on-line food store," in Proceedings of the 5th international conference on Intelligent user interfaces. ACM, 2000, pp. 260–263.