AlleRT: Food Recommender Web Application with Allergy Filtration

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Abstract

An allergy is a person's reaction when exposed to chemicals, typically harmless for other people in an environment. Allergens are believed to occur in dust mites, animals, pollen, flies, ticks, molds and some medicine. As 20% of household middle incomes go to restaurants to go for a bite. One in a family of five will likely have allergies to the food they eat. Being exposed to substances is a daily occurrence for an individual and there is always a chance to be exposed to unknown chemicals that can harm a person without knowing the contents of the substance. This paper focuses on helping users navigate safely in the menu of a restaurant with their allergies considered. The developed system followed a software methodology system that includes gathering of data, requirements analysis, system design, implementation, and testing. A user acceptance testing was conducted with a satisfactory result.

Keywords
Decision Support system, Food allergies, Information retrieval, Users and interactive retrieval, e-Health, Food Recommender.

1. Introduction
A primary research focus in the fields of information technology was the "Decision Support System" (DSS). DSS was described as a computerized system used to help organizational decisions in pursuit of advanced decision support systems implementation. DSS has always been a recognized research topic. Recommender systems are well supported in the foundations of incremental rules. The rules of these systems could differentiate from one data to another in respect of strengths and weaknesses. Using both systems, DSS would be able to create statistical data from the population that uses the recommender system such as interests, characteristics and traits.

Food has various traits and characteristics that can go well with these systems and it is one of the basic needs of an average everyday Filipino. Even if it is a basic need of Filipinos, it can be harmful to lethal because of allergies depending on the severity of that person. Food Allergy is leading to adverse health effects that affect 4% to 7% of our population (Burks et al. 2020). Food allergies can cause an estimated 150-200 people to die every year (Lokman and Akoglu, 2022), and half of the estimated person died because of the fatal reactions happening in a restaurant or any fast-food chain. The eight most common food allergies represent 90% of all food allergy reactions and these are; Milk which is the most common food allergy in infants and children including butter, cheese, and ice cream; Egg next to milk allergy in children; Peanut being one of the most common allergy; Tree nuts including walnuts pistachios, pine nuts and any kind of nuts; Soybean being one of the most common allergy in children; Wheat allergy usually below three years old; Shellfish allergy includes shrimp, crab, lobster and mussels; and Fish as last of the most common allergy.

Food establishment owners should be aware of the allergies of their customers since it will affect the reputation of their business. This research focuses on the development of a healthy food recommender system, which is based on the user's personal info he/she provided for his/her profile (Toledo et al. 2019).

1.1 Objectives
The main objective of the study is to develop a web-based Application for food recommendation system specialized in allergy information for people with allergies. Specifically, this research aims to develop a user management module to monitor each user in the system, a food category module that will view several food options, and an allergy checking module to be able to display what kinds of allergies are present in the selected menu.

The food recommendation system that processes the dietitian with their selected food establishment and based on their food preferences that can also be customized. It will also display which food establishments contain their allergic food to avoid allergic reactions. The target users for our system are food establishment and people with allergies specifically in foods.

The food recommendation system would be accessed by the food establishment owner by creating an account for their restaurant to upload their food menus in the website and a person with an allergy by checking the application, specifically the menus of the restaurant. The restaurant can only be accessed by verification by sending an official email with legitimate documents.

2. Literature Review
The service of a restaurant recommendation system accuracy and sophistication increases every day. The study presents a personalized mobile based restaurant recommendation system integrated in a mobile technology. It studies the users of past interactions and behavioral patterns of visited restaurants with the use of machine learning algorithms. The system is divided into two parts which is the online activity and the processed data offline. When the user is moving, the system goes online retrieving nearby restaurants and its details such as ranks, the scores of the restaurants are generated offline based on the retrieved data of the restaurants (Asani et al. 2021).

In any modern application the recommendation system can be found that exposes the user to a collection of items. Generally, a recommender system usually gives the user a list of recommended items they prefer or predict an item that the user might want instead. This lets the user decide on the right items and makes it easier to decide on their preferred items in the set. Most approach of a recommender system is that they focus on the most important items based on the individual user's profile (Sun and Zhu 2019). The context of the user defines the user's state of information such as physical, social and emotional wherein the context needs to be a subset of interest of a particular entity (Al-Ghuribi and Noah 2019).

In order for the study to obtain contextual information is to directly approach an individual and gather the information using surveys or gather information to study the behavior of the user's change of location such as a phone with a GPS or studying past searches and transactions of the user. Now the post-filtering approach first ignores the contextual information, filtering out the unnecessary information then adjusts the ranking of the recommendation on the list (Herse et al. 2018).

3. Methods
3.1 Synthesis of Review of Related Literature
Food Recommendation System is an example of a web-based application that focuses on identification of food preferences of the user. Its unique feature is the provision of a filtration system that generates the list of food establishments and the individually identified details on their menus. The generated results depend on the data which the users enter in the application. For example, if the user wants to select a Korean cuisine, the application would provide a list of food establishments and their preferred meal for the user based on the personal details of the user. As this research involves food establishments in a locale, that is, Barangay Población, Makati City, Google Maps is integrated into the system. With this spatial outlook, the application also yields results of food establishments based on their proximity to the users (Zhang et al. 2018).

Hypertext Preprocessor (PHP) is the programming language while Cascading Style Sheets (CSS) is the style sheet language in developing the Food Recommendation System. PHP and CSS are used as the programming and style sheet languages in this web development because these two are highly utilized and recognized languages in the academic community and in the industry (Mahadiet al. 2018).

In the web development process, the website shall first be connected to a server. XAMPP, which stands for Cross Platform (X), Apache (A), MariaDB (M), PHP (P) and Perl (P), is an opensource software that shall be used as the server in this web development. Likewise, XAMPP servers shall also be used in creating the database and in testing the application's connectivity (Sun et al. 2020).

Regarding the generation of information about the food preference of the user, the results shall depend upon the users' entry of data. The study intends the application to be user-friendly, particularly in yielding accurate reports and ensuring that users can fully rely on such accuracy (Trang Tran et al. 2018).

3.2 Platform, Framework, and Reference Technologies
Netlify - Netlify is an all-in-one platform for automating modern web projects. Replace your hosting infrastructure, continuous integration, and deployment pipeline with a single workflow. Integrate dynamic functionality like serverless functions, user authentication, and form handling as your projects grow (Attardi 2020).
REACT - React. js is an open-source JavaScript library that is used for building user interfaces specifically for single-page applications. It's used for handling the view layer for web and mobile apps. React also allows us to create reusable UI components (Saundariya et al. 2021).
Firebase - Firebase is a Backend-as-a-Service (Baas) (Khawas and Shah 2018). It provides developers with a variety of tools and services to help them develop quality apps, grow their user base, and earn profit. It is built on Google's infrastructure. FireW13base is categorized as a NoSQL database program (Ahmed et al. 2018), which stores data in JSON-like documents (Bourhis et al. 2020).

3.3 System Architecture
The general system architecture of a restaurant recommender system, as shown in Figure 1, wherein the system would determine where the current user is located using GPS. The user would then prompt the system to search for nearby restaurants that would be displayed in a map. Then, after searching for nearby restaurants, the recommendation engine would then highlight the top picks of restaurants for the user. This would only work if the user has an account in the system. When the user has completed providing their user profile and interest, the recommendation system would then base their results on the user's preference.
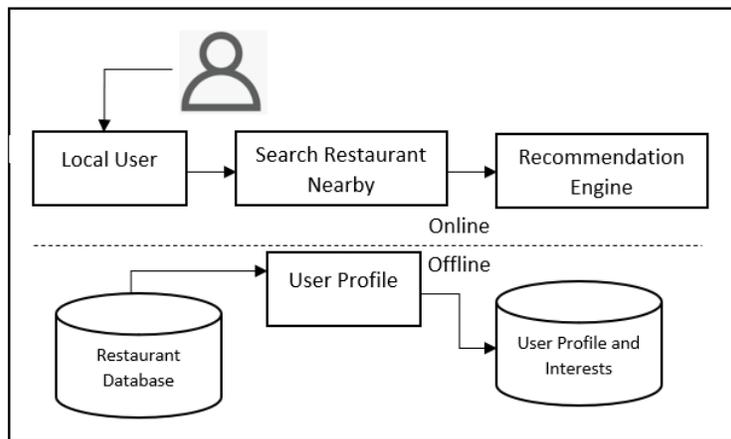

Figure 1. System Architecture

3.4 Conceptual Framework
The developed framework, as shown in Figure 2, is composed of the following parts:
Graphical User Interface: it allows the user to register his or her personal details, set preferences and ask for recommendations
Restaurant Ontologies: The recommender engine will need the information provided by each of the restaurants (Restaurant features) on the web and will be able to get it as a Web service.
Database: the user's personal information and preferences are stored in the database.
Knowledge Base: Based on the restaurant ontologies, user preferences and models wherein it classifies restaurant menu items and restaurants according to the user's preferences. The recommender engine will then make appropriate

recommendations by querying the information from the restaurants. The recommendation will be highly based on the detailed preferences provided by the users.
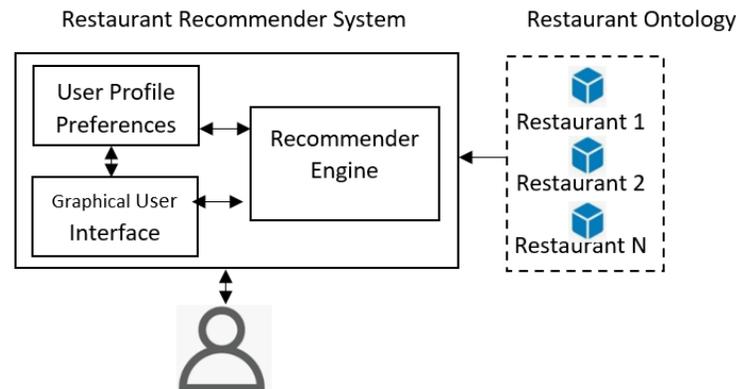

Figure 2. Framework for Restaurant Recommender System

3.5 Research Design

This study aims to use a qualitative approach in means of research since it dealt with the analysis of data obtained with the use of the developed system. The study shall create the application once said requirements are met. PHP and CSS shall be used in programming and data-storage of Food Recommender System because these two are highly utilized and recognized languages in the academic community and in the industry. When the analysis workflow has been done, the study can already build the design model of the system on how the system will perform and what will be the components in the implementation.

3.6 Research Locale

The study chose three (3) selected food establishments in Metro Manila as the base of this research. An interview with two registered Allergologist from various highly recognized hospitals in the Philippines was done to collect data or knowledge about food allergy.

3.7 Research Respondents

The participants were composed of 2 participants consisting of an End User (people with allergy) and a Food Establishment Owner. End User (people with allergy) and a Food Establishment Owner are included to verify if all the functionalities are working and within the standard and to validate the developed system against the functional and non-functional requirements.

3.8 Research Instrument

This study used a survey questionnaire that concerns their field of expertise. The questionnaire was made available through sending a link of google form to the food establishment owner and to the end user (people with allergy).

3.9 Samples and Sampling Techniques

After the web application has successfully verified the requirements are met and completely implemented and passed all the user testing and addressed all the feedback from the user for the improvements of the system that is based on the previous initial testing. All the users will be asked to evaluate the web application. The study used Convenience Sampling. Respondents were food establishment owner and end user (people with allergy).

3.10 Data Gathering

In the data gathering, the goal is to state the requirements of the web-based application functionalities by gathering related literature and studies. The data from these literature and studies provide bases for the development of ideas, concepts and structures concerning the web-based application. These provide comparative perspectives on different approaches in technology-enabled responses to issues, in this case food and allergens and nutrients, in various countries. More so, these studies and literature treat the strengths and weaknesses of similar web-based applications, and on how these strengths can be adopted and weaknesses addressed in this web-based application. To ensure the

accuracy and precision of generated information, experts in the field of food and nutrition will be the primary source of information in respect to dietary meals plans, an ideal for a healthy lifestyle of target users. Interview and thorough collaboration with experts will be conducted all through the course of study. They are primarily the target users of the proposed system. Series of interviews were made with registered nutritionist/dietician, pediatrics, allergology and immunology from various prestigious hospitals in the Philippines, as well as interview with food establishment owner.

3.11 Analysis
The design gathered information about the different types of food categories and allergies for the recommender engine to work efficiently. Through this, the needed requirements of the system were established and fulfill those requirements through the provided information.

3.12 Development
This is where the coding starts. From the first requirement to the last requirement, the team build the system. In building the program, Netlify, REACT and Firebase were used.

3.13 Testing
Functionality testing was conducted to check whether all the web application components have been properly implemented. We will also ask our respondents to answer the User Acceptance Test Questionnaire to check if the web application requirements are met.

4. Results and Discussion
The web application conducted a testing through online with the food establishment owner and end user (people with allergies). The User Acceptance Test Questionnaire was sent through Google Forms to food establishment owners and end users (people with allergies). A demo of the web application was done through Zoom Meeting to discuss and how to use the web application to all users. After the demo of the web application, the UAT questionnaire through Google Form to answer if they are satisfied or not about the web application. After the testing, there was only one (1) person who verified as a food establishment owner and seven (7) people who have allergies. Since there are a limited number of respondents for the testing especially to food establishment owners. To show the result of the UAT questionnaire, we divided into two (2) results by separating the result of food establishment owner and end user.

4.1 Result of Food Establishment Owner UAT Questionnaire
A 50-year-old restaurant owner served as our one (1) respondent who is a verified food establishment owner to test our web application. We conduct a demo of our web application to her through Zoom Meeting since it's a pandemic. We can't have a physical test or physical demo of our web application to her but in this way of online demo we can still present our web application to her on how the web application works. After the demo we asked her to answer the UAT questionnaire about the web application.

According to the food establishment owner, the web application that the group developed is useful for customers to navigate through their menu without having concerns with their allergies since the present allergies in the menu are already stated. The web application is still in the development stages, so she stated that the application needs more restaurants instead of adding more features to the web application, so the features of the web application were already satisfactory for her. The only thing the food establishment owner took notice of was the lack of meal pictures from the restaurant menu at the time when the web application was shown. Overall, the food establishment owner is satisfied with the web application to help her customers enjoy their meal and other users, both restaurant owners and customers, by recommending this web application.

4.2 Results of End User (People with Allergy) UAT Questionnaire
After the demo of the web application for End User (People with Allergy), we asked them to discuss or to give feedback about the web application. According to the respondents of end user respondents, most of them thought that the web application does not need additional features for it. The other users that have thought otherwise said a blog feature for the website and picture preview of meals on restaurant menus. since the web application is still in its early stages, there would be more allergies to be added. Most users said that the web application made it easier for them to look for the meal they have in mind without caring for the allergy they have since the allergy they have already sorted out the meal that has it from the menu which makes it easier to look.

From what we can observe from Figure 3, the respondents are within the age bracket of 15 to 25 or for more accuracy, between the age of 19-23 with the average age of 21.
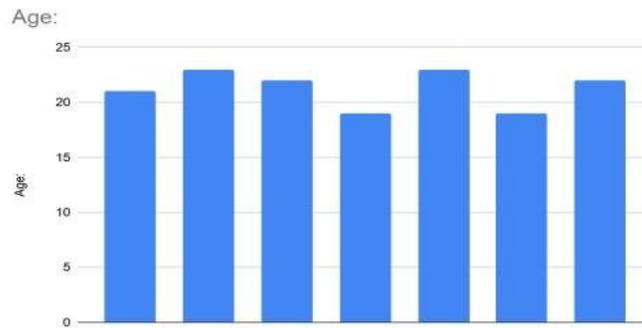

Figure 3. Ages of Respondents

We can observe the Allergies of Respondents based on Figure 4, most of the respondents have allergies with Shellfish being the most allergic in the chart.
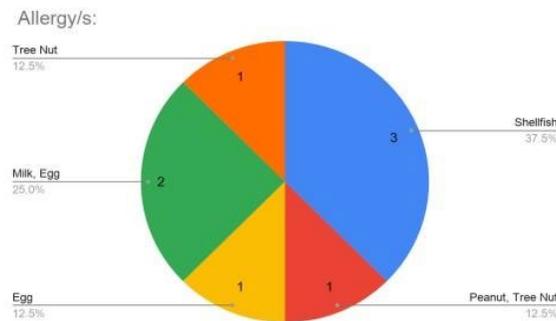

Figure 4. Allergies of Respondents

We could observe from the first question of the UAT End User on Figure 5 that most of the respondents are satisfied and very satisfied with the web application being clear with the texts.
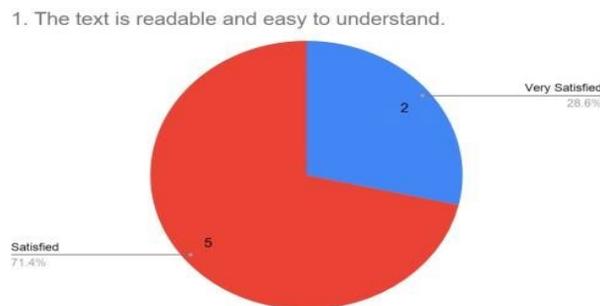
Figure 5. 1st Question of UAT End User

We could observe from the second question of the UAT End User on Figure 6 that the respondents are mostly satisfied with the system's functions and easy to navigate with one being neutral with the system.
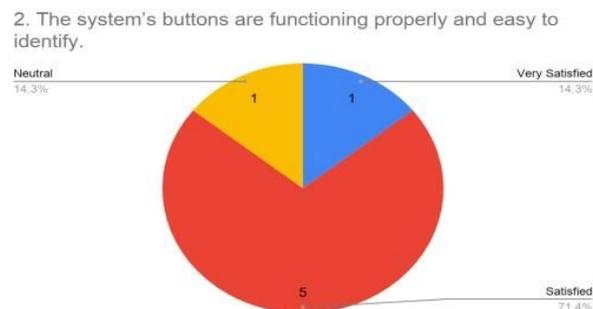

Figure 6. 2nd Question of UAT End User

We could observe from the third question of the UAT End User on Figure 7 that most of the respondents are satisfied with the color scheme and doesn't strain the eyes of the users.
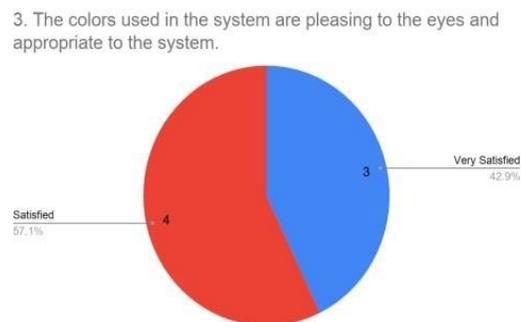

Figure 7. 3rd Question of UAT End User

We could observe from the fourth question of the UAT End User on Figure 8 that the respondents are mostly satisfied with how easy it was to navigate through the web application.
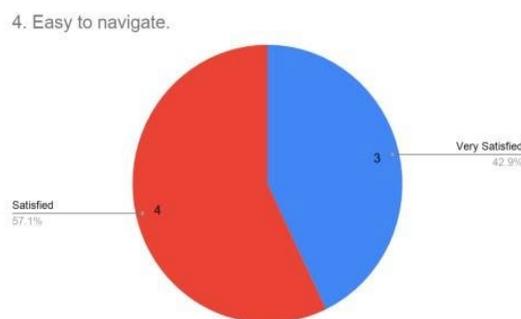

Figure 8. 4th Question of UAT End User

We could observe from the fifth question of the UAT End User on Figure 9 that the respondents are mostly very satisfied with the design and color scheme of the whole system.
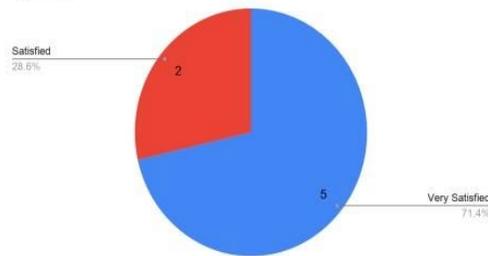
Figure 9. 5th Question of UAT End User

We could observe from the sixth question of the UAT End User on Figure 10 that the respondents are mostly satisfied with the allowance of space with the web app by being adaptive with the resolution of the users
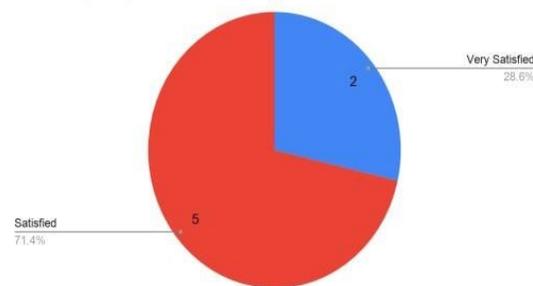

Figure 10. 6th Question of UAT End User

We could observe from the overall rating result of the UAT End User on Figure 11 that the respondents are mostly satisfied with the we application.
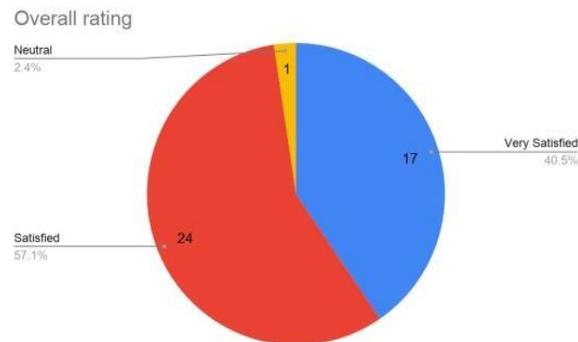

Figure 11. Overall rating of UAT End User

5. Conclusion

This study aims to develop a web-based application food recommendation system specialized in allergy information. Through, this course of study, we have implemented a user management module wherein the admin monitors the users in the admin dashboard. In the user management module, the admin can observe the basic information of the users such as name, email and allergy information. The allergy filtration, or the allergy checking module, can help the users find a safe suitable restaurant to dine in and enjoy. We have also implemented a food category module in the search feature, along with the allergy checking module, to easily display the safe meals for the user as well as the restaurant the meal is available. Users can also help one another by leaving feedback to restaurants on how good or how bad their services are. It can also serve as a warning whenever there is allergy residue stuck on the cooking station.

In order to have an easy evaluation of the users in the web application, an admin dashboard was added to the admin account so that the admin can oversee which users were using the web application and which food allergy was most common among them. The number of restaurants and which category was most common in the web application can also be seen in the admin dashboard. The results show that according to the respondents, the system is easy to use throughout the testing; and all of the features were used and only a few respondents asked for improvements in the system.

6. Recommendation

The study recommends having a physical test with the food establishment owner and end user (people with allergy). The testing is conducted online due to the pandemic the researchers can't hold a physical testing of the web application with the food establishment owner and end user (people with allergy). This study also recommends having an actual demo to everyone to see if the web application is useful to all allergens and to have multiple respondents since there were only a limited number of respondents for the testing especially in food establishment owners. Additional features to the web application is also further suggested.

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