

Allergy Bot the Intelligent Way to Predict Food Allergy

Nor Azlina Abd Rahman, Yogeswaran Nathan and
Edwin Chan Chin Hui

Abstract--- Allergy Bot is also known as Smart Allergy is a mobile application that provide smart-messaging application to let the user capture and collect crucial information about their allergies and health. By using artificial intelligent and highly developed algorithms, Allergy Bot detects which food is causing the reactions and allergic symptoms. In fact, user's interaction with the application will help the application learn the user's behaviours and become more personalized to the user as it also gradually improves the accuracy of the allergy prediction. As a result, Allergy Bot could help user allergies without compromising nutrition and their quality of life, thus contributing to improving user health. This paper is reviewing several existing system such as Alli App, Food Intolerance and Ada system to identify any lacking or improvement of the systems that needed to apply to the Allergy Bot framework. On top of that, users' requirements are also gathered and analyzed to identify the features that need to be included to the framework. Allergy Bot framework is proposed based on the research on similar system and users' requirements. Detail components of the framework are being explained.

Keywords--- Food Allergy, Allergy Bot, Prediction, Intelligent, Artificial Intelligent

I. INTRODUCTION

Food allergy is a rising health concern. According to FARE, a food allergy research and education organization studied shown as many as 15 million people have a food allergy in the US with an estimated 4%, of the adult has at least one allergies and nearly 8% of the child have food allergies [1]. The rise in the number of food allergies due to no exact treatment plan that can cure food allergy, but strict avoidance of allergens and early recognition of the trigger can prevent serious health consequences.

Despite, allergy specialist will usually recommend an elimination diet plan to uncover unknown food allergy through food journaling. Allergy test such as skin-prick or blood test has confirmed many allergy sufferers' allergen, but a study in the journal Pediatrics suggests that allergy diagnoses should not be made solely on results from such trials [1]. Test results could cause the children to have their diets limited by food allergies or due to suspected intolerances. In extreme cases, it can contribute to malnutrition. More commonly, unnecessary avoidance of food can contribute to an unhealthy relationship with food. If an individual suffers from a food allergy, it needs to be

Nor Azlina Abd Rahman, Asia Pacific University of Technology & Innovation Technology Park Malaysia, Bukit Jalil, Kuala Lumpur, Malaysia. E-mail: nor_azlina@apu.edu.my

Yogeswaran Nathan, Asia Pacific University of Technology & Innovation Technology Park Malaysia, Bukit Jalil, Kuala Lumpur, Malaysia. E-mail: yogeswaran.nathan@apu.edu.my

Edwin Chan Chin Hui, Asia Pacific University of Technology & Innovation Technology Park Malaysia, Bukit Jalil, Kuala Lumpur, Malaysia. E-mail: c.edwin2011@gmail.com

identified as soon as possible before the allergy food increases. Dr. Kate Grimshaw also warned that not all allergies could be detected purely measuring levels of protein in the blood which is known as immunoglobulin E (IgE) which is linked to allergic reactions [2].

Rural residents often experience the barrier to access healthcare that limits their ability to obtain the care they need. Allergy sufferers need to follow up with doctor frequently to keep their doctor observe and diagnose their current stage because the doctor needs to prescribe medication and adjust their treatment to keep the allergic reaction under control [2]. Hence, the researcher will used the approach of allergy diary to help allergy sufferers monitor their symptoms and help the doctor better diagnose an allergy. It is recommended to back up the allergy test result with allergy dairy, but it is a little detective work to browse through an extensive list of food records. It will be much effective if it is analyzed by the app and later review and advice by the doctor to enhance the treatment plan further.

II. REVIEWING SIMILAR SYSTEM

There are several similar system that already exist for food journaling and allergy application. Three systems were reviewed to understand the functionality and loop hole that exist in the current system.

2.1. *Alli App*

AlliApp's easy smart-logs as shown in figure 1 allows the user to capture and collect crucial information about their allergies and health. By enabling user to capture their symptoms or food to detects which food and environmental factors are causing the reactions and allergy symptoms. This rich-data sets will allow the user to eliminate allergies hazards and reveal by their doctor. Besides, the application has the lowest installs among the other application. It is because the app only targets the allergy sufferers. However, this application does not implement artificial intelligence and user often complain on Google playStore about the limited functionality [3].



Figure 1: AlliApp [3]

2.2. *Food Intolerance*

Food Intolerance list has 100,00+ installs with 4.1 rating which consider an excellent app, but the app is targeting user who suffer from lactose, fructose, histamine, gluten, sorbitol or salicylic acid intolerance as shown in figure 2. The app will adjust to individual intolerances and calculates their compatibility for each food. The compatibilities

are displayed in a simple traffic light system, ranging from green to yellow and orange up to red. If a recommendation does not apply to the user, user can easily save their tolerance for the food concerned [4].

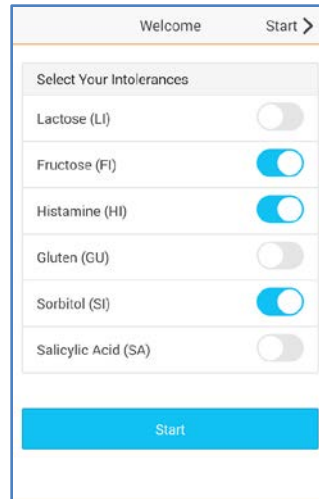


Figure 2: Food Tolerance [4]

2.3. Ada

Figure 3 shows the Ada interface system. Ada has the highest installs among all the apps that the researcher compared. It is created by doctors, scientists, and engineers to put free, AI-powered healthcare in everyone's hands [5]. The app objective is to let user understand what could be wrong by asking a serial of questions to diagnose the symptoms. Besides, it is not particular targeting allergy sufferer. It is known to diagnose thousands of symptoms and conditions, from a common cold to rare diseases [5].

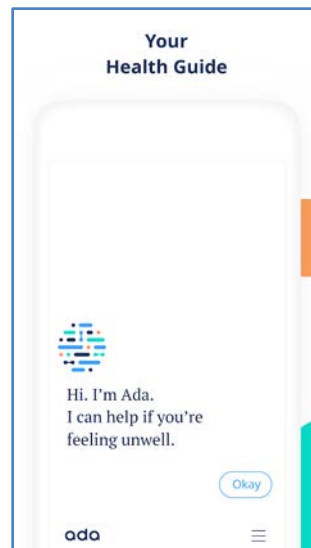


Figure 3: Ada [5]

Through the investigation and research of similar applications, the researcher realized there are limited quality and useful application regarding on food allergy on the app store. One of the factors the researcher believes is the

problem domain is too narrow to attract the developer. Therefore, the application such as Ada and Alliapp is the dominant player in the area.

The researcher found that Alliapp has the lowest installs among the apps compare to Ada and Food Intolerance list, though, it has insufficient features which only support the basic create, save and view the record. Unlike Ada, it has the most install and uses artificial intelligence to analyses user's symptoms to help diagnose the disease. Besides, the researcher also analyze the reviews on the app store to understand the strengths of weaknesses of these apps. Therefore, it can consider these features in the proposed application to provide the user with better and more comprehensive allergy food dairy application.

III. RESULTS AND DISCUSSION

Online questionnaire prepared and distributed to random users and the researchers manage to get 40 responses. All the responses are analyzed in this section to get the user requirements towards the proposed system.

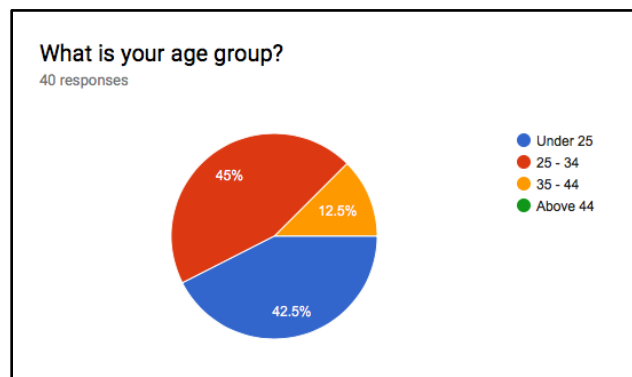


Figure 4: Age Group

Graph in figure 4 shows the result of a survey in which respondents were asked about their age group. From the pie chart, it shows the highest selected age group is 25 – 34 with slightly higher percentage compared to under 25. However, the age group of 35 – 44 only stands at 12.5 %. This result might influence the method used on disturbing the survey, but this finding can help the researcher to investigate further on the preferable approach for each unique age group.

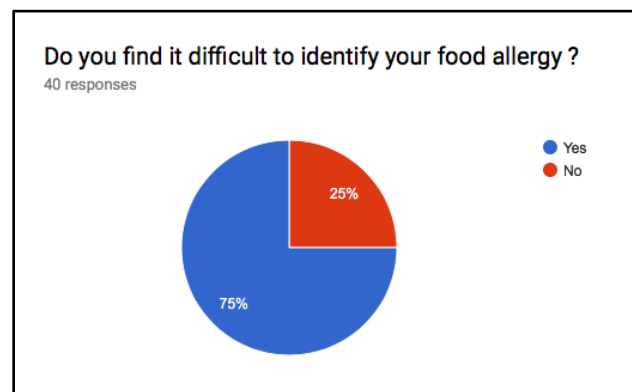


Figure 5: Food Allergy Identification

Figure 5 shows the result of a survey in which people find it difficult to identify their food allergy. From the pie chart it is clear that the majority of participants have difficult on identifying their allergen with just 25% of the participants do not encounter this issue. This is due to food allergies are associated with a broad range of signs and symptoms. The symptoms may involve any body system, including the skin, gastrointestinal and respiratory tracts, and cardiovascular system [12]. Detail history and physical examination requires diagnosing the food allergy and any diagnostic tests that need to be conducted such as skin prick tests (SPT) and /or food-specific serum Immunoglobulin (IgE) assessment [12].

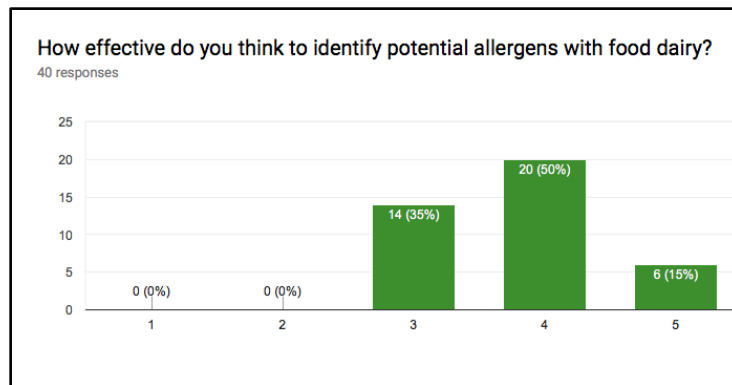


Figure 6: Effectiveness of Food Dairy

The respondents were asked about how effective they think food dairy is, to identify potential allergens. Based on the bar chart in figure 6, 14 responses on the scale of 3 which shown this group of respondents unsure about the effectiveness of a food dairy. Besides, the scale of 4 has the highest response which consists of 20 responses. Food diaries or diet diaries can be used as an adjunct to history, in providing or to recall of foods eaten and the timing of symptoms provoked. Patients need to keep a chronologic record of all foods taken over a specified period of time, including items just placed in the mouth, such as teething any cookies or sweets, and any symptoms that develop. Most of the time a review of the diary reveals unknown sources of contamination or hidden food allergens. Occasionally the diaries prepared may give an idea on relationships between foods taken and symptoms experienced. Commonly diet diaries had proved effective in the evaluation of chronic disorders, such as atopic dermatitis and allergic eosinophilic esophagitis or gastroenteritis [14].

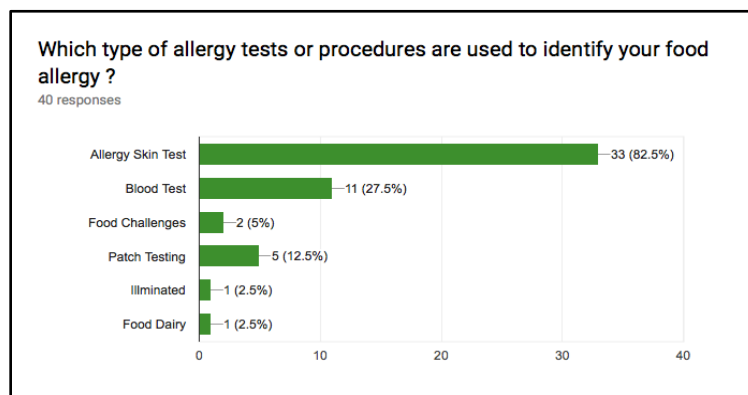


Figure 7: Procedures to Detect Allergy

The respondents were asked about the type of allergy test the respondents have used to identify the allergy. Based on the chart in figure 7, 33 responses or 82.5 % of the respondents selected allergy skin test, it might be because the affordability and availability of the test. Moreover, Skin prick tests (SPTs) are a fast and effective method of assessing sensitization to food allergens. SPTs are highly reproducible and affordable as it is less expensive than *in vitro* testing. Skin testing is more convenient by most of the patients as the test can be safely performed in patients of any age; it causes minimal patient discomfort, and yields results within 15 minutes [13].

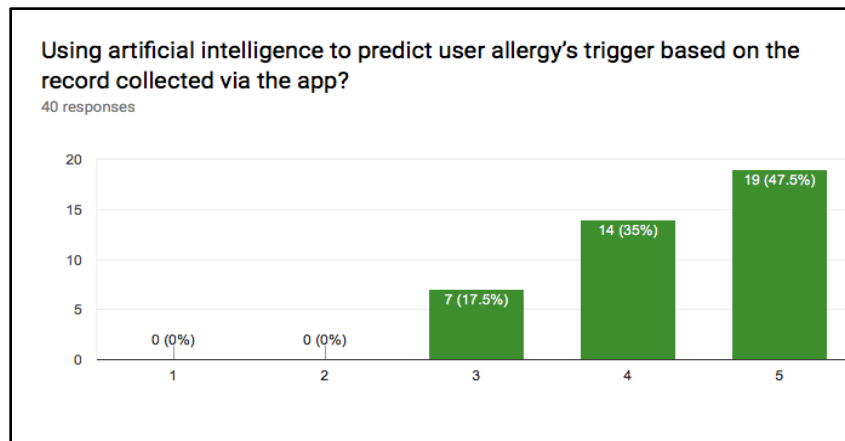


Figure 8: AI integration in Predicting Allergy

The survey in figure 8 referred to capture the usefulness of predicting user allergy. Participants were asked to rate the usefulness of the features in the scale of 1 to 5. As a result, scale of 5 has the highest response which consist of 19 response. Followed by the scale of 4 as the second highest. Therefore, the researchers will include this feature in the proposed application.

IV. ALLERGY BOT FRAMEWORK

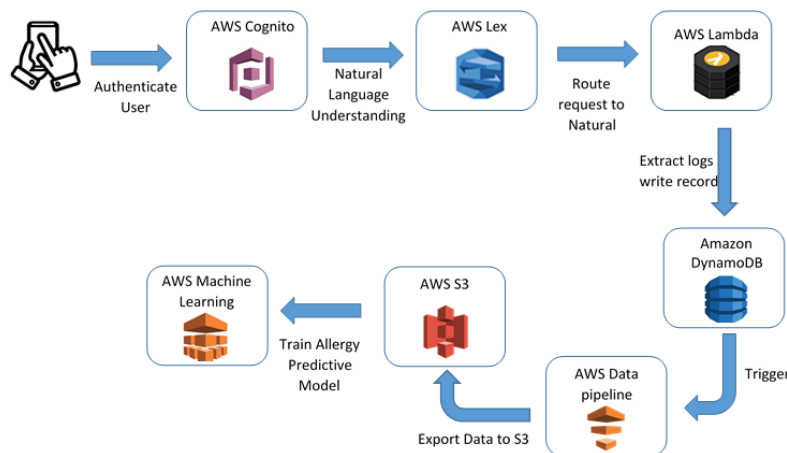


Figure 9: Allergy Bot Framework

Smart Allergy is a conversational food journaling app designed to help the user manage their daily food logs faster, easier and smarter. With Smart Allergy, the user can now easily record their allergy trigger, food logs, view history data and get allergy food prediction. The app has adopted a server less architecture by using Amazon Web Services to decrease production cycles, increase agility and move faster as it digitizes. The section below discusses

in detail about all the AWS services as shown in figure 9 that the app utilizes to scale with minimal engineering effort.

AWS Cognito

The process starts with using AWS Cognito, it is a simple user identity and data synchronization service that helps you securely manage and synchronize app data for your users across their mobile devices. It will authenticate the user before forward to next level for verification purpose [6].

AWS Lex

Automatic speech recognition (ASR) and natural language understanding (NLU) are some of the most challenging problems to solve in computer science, requiring complex deep learning algorithms to be trained with vast amounts of data and infrastructure. With Amazon Lex, it enables the developer to define entirely new categories of products made possible through conversational interfaces [7].

Amazon Lex is a service for building conversational interfaces into any application using voice and text. It provides the high-level deep learning functionalities of automatic speech recognition (ASR) for converting speech to text, and natural language understanding (NLU) to recognize the intent of the text. It has enabled Smart Allergy to have highly engaging user experiences with conversational interactions [7].

AWS Lambda

AWS Lambda is an ideal compute platform for various application scenarios, and the developer has used Node.js to implement its application code which is one of the supported languages by AWS Lambda to execute its code in AWS Lambda runtime environment and resources provided by Lambda [8].

When using AWS Lambda, the developer is solely responsible for the code. AWS Lambda will manage the compute fleet that offers a balance of memory, CPU, network, and other resources. This is in exchange for flexibility, which means the developer cannot access the compute instances or customize the operating system (AWS Lambda Developer Guide, 2018). Therefore, the developer has used this service to validate user query after analyzing by AWS Lex and also save data to the database [8].

Amazon DynamoDB

It is a fully managed NoSQL database service that allows to create database tables that can store and retrieve any amount of data. It automatically manages the data traffic of tables over multiple servers and maintains performance. It also relieves the customers from the burden of operating and scaling a distributed database. Hence, hardware provisioning, setup, configuration, replication, software patching, cluster scaling, etc. is managed by Amazon. It will extract the logs from AWS Lambda and change the outcome into a trigger [10].

AWS Data Pipeline

It is a web service, designed to make it easier for users to integrate data spread across multiple AWS services and analyze it from a single location. Using AWS Data Pipeline, data can be accessed from the source, processed, and

then the results can be efficiently transferred to the respective AWS services. It is using a trained Allergy Predictive Model to give recommended answer for the user [11].

AWS Machine Learning

Amazon Machine Learning is a managed service for building ML models and generating predictions, allowing the development of robust, scalable smart applications. The developer has used AWS Machine learning to perform tasks such as data analysis, model training, and evaluation.

In the data analysis step, the food logs and other data are computed and visualize suggesting transformations that optimize the model training process. The model training process finds and stores the predictive patterns within the transformed data. In the final step, the model is evaluated for accuracy [9].

V. CONCLUSIONS

The initially stated objective of this research was to provide an alternative cost-effective food allergy solution to all users. While recognizing the limitations of the solution, the researchers believe that they have largely achieved and tested the fundamental idea of a virtual assistance to help user logs food record and provide insight and make prediction for user. The researchers have developed and tested the idea by building an iOS mobile application in beta version. They did a beta launch to gather feedback from the food allergy community. Following the feedback, it helps the researcher to understand the user's need and the application limitations. The researchers have realized the food allergy prediction made by the application is likely inaccurate at the beginning due to lack of data. Nevertheless, the application makes several successful attempts in real time after the researchers include a trained-model to better predict food allergy for an individual.

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