AllergyBot: A Chatbot Technology Intervention for Young Adults with Food Allergies Dining Out

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Abstract

Dining out is one of the biggest challenges people with food allergies face. For young adults, especially, the fear of having an allergic reaction when dining out impairs social aspects of their life. The exhausting process of searching online and communicating with restaurants also increases their anxiety.

To improve the quality of life for young adults with food allergies, we present AllergyBot, an intelligent and humane Chatbot that provides restaurants' allergy accommodation information based on users' allergens. We use established instant messaging platforms to create a form of conversation that young adults are familiar with. AllergyBot aims to reduce the users' inquiry overload, improve their overall dining out experiences, and support their social life.

Author Keywords

Food Allergies; Chatbot; Conversational Design; Human-Robot Interaction; Artificial intelligence.

ACM Classification Keywords

H.5.2 [User Interfaces]: User centered design, Screen Design, Evaluation/methodology; H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.
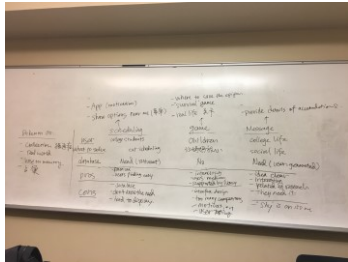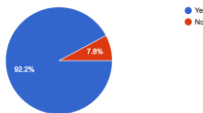
Figure 1. Group Brainstorm

Figure 2. Ideation

Figure 3. Survey Findings

Introduction

It is estimated that up to 15 million Americans have food allergies, and the number is growing. *Food Allergy Research & Education (FARE)* has reported that 1 in every 13 children is affected by this potential fatal disease, and a study has shown that food allergies among children increased approximately 50% between 1997 and 2011 [9]. Such alarming statistics suggest that future generations will continue to suffer from life threatening food allergies at an increasing rate.

In fact, young adults suffer more anxiety compared to other allergy age groups because they have the most social needs and consequently they are exposed to higher risks. Without the constant support of their families, many find it difficult to learn how to avoid danger and adapt to new social changes as they grow up [5]. We found that because of the lack of awareness about the severity of food allergies [8] the public often neglects regulations in public places. Such knowledge gaps cause difficulties in many quality of life issues for those suffering with food allergies.

Therefore, we started our design process by asking, "is it possible to design something that could alleviate the daily struggles for young adults with food allergies and improve their quality of life?"

Methodology

Our team adopted the funnel research method and human-centered design approach. We started by thinking big—understanding food allergies and existing solutions for all ages—and then narrowing down to young adults. Our team highly valued feedback from users and accordingly set up constant user reviews for iterative design cycles.

Literature Review

To better understand food allergies and their impact on our users, we conducted literature reviews through various journals, online articles, and research papers.

Quality of Life Issues
Research has demonstrated that individuals with food allergies may experience impaired quality of life through elevated anxiety, stress, or social isolation [6]. Young adults with food allergies indicated higher anxiety levels than non-allergic adults [11]. Young adults are also the group at highest risk for fatal allergic reactions [4]. The expected attributable social and emotional contributing factors include risk-taking behavior with eating [13].

Risks of Dining-out
Deaths caused by food-induced anaphylactic reactions are increasing, with most caused by food purchased outside the home [3]. Restaurants and non-commercial food service establishments are found responsible for most of the food allergic reactions, due to the following factors: cross-contact, hidden allergens, miscommunication between wait staffs and cooks, ingredients not being declared at restaurants, and skin contact with food residuals [11]. In fact, a recent study shows that more than 10 percent of the servers, food workers and restaurant managers reported false and hazardous beliefs that customers with food allergies can safely eat small amounts of the food that they're allergic to [10].

It is recommended that before dining out, people with food allergies should ask for others' recommendations, view menus online, and call ahead to talk to the manager [7]. However, young adults with food allergies

"Because it is difficult, I only dine out once or twice a month and it must be a restaurant that I really trust."

"Once, a restaurant asked me to leave after I asked them lots of questions."

"Sometimes I take an adventure to dine out in a restaurant and get a little poisoned by the food."

Figure 4. Quotes from the Interviewees

"My restaurant is able to accommodate customers with food allergies, but I do not want to appeal it, because more food-allergic customers coming to the restaurant will be a burden."

"We are a chain store and it is hard for us to provide accommodation."

Figure 5. Quotes from the Restaurants Owners

found that they often viewed themselves as burdens for inconveniencing servers and restaurants [11].

Competitive Analysis
Existing Designs and Solutions

- Food detecting devices: Allergy Amulet is an allergen detection device. Users insert test strips into their food, and the reader alerts users if allergens are present [2]. Nevertheless, for users who have several allergies, they need to buy several devices.
- Restaurant recommendation platform: AllergyEats helps people with food allergies to find restaurants [1]. However, such reviews are static and often outdated, which reduces its reliability.
- Legislation: it would be ideal to enact laws to improve food allergy awareness in restaurants, but implementation is difficult.

User Research
Phase One: Survey & Expert Interviews (Figure 4)
A survey was distributed among University of Michigan, *Food Allergy & Anaphylaxis Michigan Association (FAAMA),* and social media over a ten-day period. The survey had 167 respondents with food allergies; 80 of them reported their conditions to be fatal. The results of our survey show that 91.3% of the 160 respondents found Restaurant/Dining Out causes the most inconvenience, and 70.6% of them feel food allergy influences their social life (Figure 3).

We also interviewed 3 food-allergy experts, including a health professional, a nutritionist, and an allergy advocate. The experts emphasized that food allergy is different from other chronic disease, like diabetes,

which can be monitored and controlled. The challenge for allergy patients is exposure. The feeling of uncertainty makes them anxious and can lead to social isolation. In addition, all 3 experts stressed that such social needs are most obvious for young adults.

Phase Two: User Interview
Our findings in the literature review and phase one led us to focus on young adults. We further interviewed 5 volunteer users from the survey to learn about their dining out and social life experience.

All interviewees reported that dining out is risky and challenging, and the process of preparations beforehand is necessary but time-consuming. One interviewee even reported spending a minimum of 2 hours checking a restaurant before dining out. Sometimes if they find out the restaurant their friends recommended is not allergy-educated, they seldom voice their concerns because they don't want to become a burden to the group.

Interviewees also reported that they usually contact their friends and talk about dining out via instant messaging tools, especially Facebook Messenger

Phase Three: Other Stakeholder Interview (Figure 5)
Realizing that restaurants are important stakeholders, we also interviewed 20 restaurants in the Ann Arbor area to try to involve them. However, most of these restaurants had great confidence in their ability to provide food allergy-educated services. These findings contradicted the feelings of our experts and user interviewees, who believe that some restaurants' confidence may come from their lack of knowledge
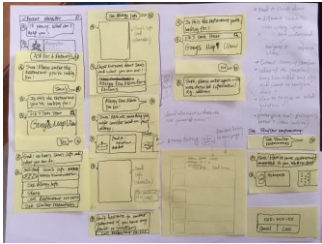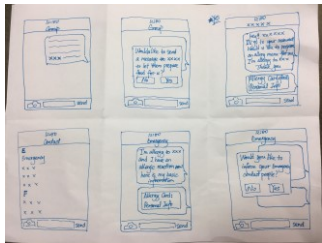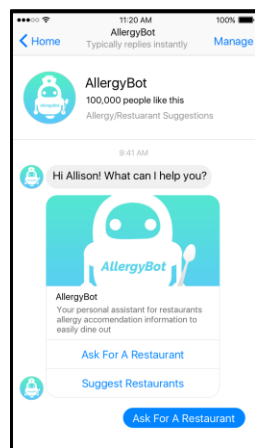
Figure 6. Wireframes

Figure 7. Paper Prototype

Figure 8. AlleryBot Opening Conversation With Users

about food allergies. Restaurants that are not allergy-educated did not show any interest in improvement.

Research Results Analysis

With results from our literature review, competitive analysis, and user research, we concluded that the core issue people with food allergies face when dinning out is that existing information delivery platforms or communication channels between restaurants and customers are unreliable, complicated, and time-consuming. We realized that a solution that addresses a better way of communicating allergy-educated information is needed.

With such a goal in mind, we also created personas to help us narrow down our design functions. Our target users have the following characteristics:

- They are exhausted by the complex searching process of finding allergy-educated restaurants.
- They do not trust platforms that lack of humane components.
- They are familiar with instant messaging platforms.
- They do not want to cause inconvenience for their friends.

Technology Analysis

With the design goal of building a more efficient and humane communication channel, the interviewees desire for an easier way to search for restaurants, and their frequent use of instant messaging tools, we decided to explore the Chatbot technology.

Chatbots are communicational agents built into instant messaging platforms. A simple Chatbot mimics conversations that react to a limited scope of user requests, commands or choices. Complicated Chatbots are artificial intelligence systems that generate answers by analyzing conversational context [12]. Moreover, existing database and API make it possible to build the initial database of Chatbots, which could be further enriched by the user-generated information.

In short, Chatbots allow information to be communicated through a one-on-one and tailored channel, which meets our goals.

The Solution - AllergyBot

AllergyBot, a Chatbot technology, aims to assist young adults with food allergies to find information about restaurants' accommodation. This bot is built in existing instant messaging apps or platforms such as Messenger and uses existing restaurants' information retrieving from APIs (i.e. Yelps… etc.). It is an innovative way to display allergy-educated information and allows users to access information conveniently in an automatic and familiar manner. They can check a restaurant quickly and tell their friends their concern during their conversation naturally, thus reducing the inquiry workload and the sense of "a burden to others."

Key Features
- Create and share personal allergy information
- Check a restaurant and see allergy-free menus
- Get reminders to contribute allergy-related reviews
- Interact with and enrich AllergyBot for it to become increasingly smart and customized
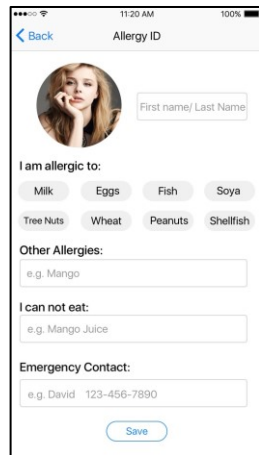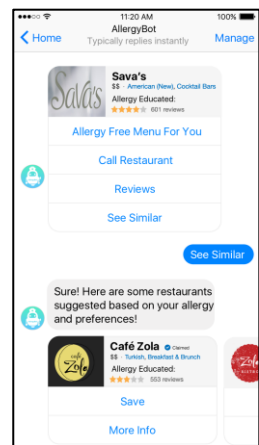
Figure 9. AlleryBot Screen: Allergy ID

Figure 10. AlleryBot Screen: Allergy-Educated Restaurants

AllergyBot starts the conversation (Figure 8) by asking users to create their personal allergy information including their allergens, the specific food they cannot eat, and emergency contact, so it can provide information related to the user's allergies. Users can also share this allergy information in the form of card, to their friends or restaurants (Figure 9).

AllergyBot allows individuals with food allergies to chat with the bot to understand if nearby or specific restaurants are allergy-educated (Figure 10). Users can also view special menus or reviews that exclude their specific allergens (Figure 11). Users can call the restaurant directly for further questions. They can save and share restaurants and menus that interest them.

AllergyBot also detects users' locations and asks the users to provide allergy-related feedback or reviews after they have visited a restaurant. This way, the iterative information cycle would help generate more data for the bot.

In fact, the more a user interacts with AllergyBot (i.e. asking for a certain type of cuisine regularly or giving reviews of a restaurant), AllergyBot will learn user's behaviors and become more customized to user's needs. AllergyBot uses casual language in a friendly tone to create relationships and trust with users.

A digital prototype is currently available at: https://www.youtube.com/watch?v=Pe109zuwOEo&feature=youtu.be

Evaluation
We conducted two rounds of user tests (Figure 12, 13). We invited 6 participants to test low-fidelity paper prototype and 8 more to test the high-fidelity digital prototype.

They were given the following tasks:
- Log in/ set up allergy ID
- Ask for a restaurant, see menu, see reviews
- Send reminders for users to write allergy-orientated reviews

Low-Fidelity Prototype
- Users liked AllergyBot because they felt like they were chatting with a friend.
- They hoped to have additional functions, like allergy-free menus and prices of restaurants, allergy related reviews based on their specific types of allergies, and a button to bookmark or save the restaurants they are interested in.
- Users were confused about when and how they will be reminded to write a review.
- Users wanted shorter text and hoped to tap the restaurant images to see basic information.

From the feedback, we added menu reviews, price checks, save restaurants, and we also added filters to the restaurant, menu and reviews based on the users' allergens. We improved the review function by having the bot send a review reminder based on location.

High-Fidelity Prototype
The main feedback are:
- Users liked both the interfaces and functions of the AllergyBot since the interface is clear and the functions are easy to follow.
- Users did not notice some texts were clickable and suggested us to provide buttons.
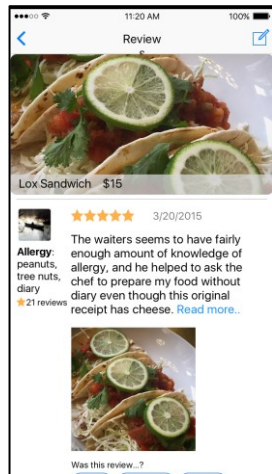- Users felt confused about the rating method.

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Figure 11. AlleryBot Screen: Restaurants Reviews

Figure 12. User Testing 1

Figure 13. User Testing 2

Users' feedback helped us to improve AllergyBot again. We unified the style of clickable content, and redesigned the rating choices.

Conclusion

We hope that AllergyBot could serve as a platform for our target users to explore dining options without inquiry overload and hectic preparations, to innovate new social changes in interacting with others, and to inspire restaurants to recognize the importance of tending to our users' needs.

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