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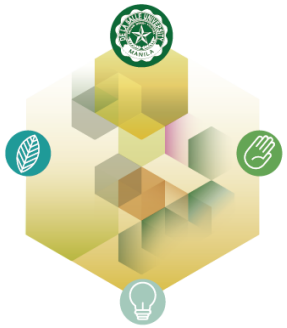

Ailbot 2.0: A Symptom Checker Chatbot for Skin Diseases of Young Children

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Abstract: Filipinos have faced multiple challenges in managing certain diseases during the pandemic. Specifically, skin diseases in Filipino children and adolescents were left uncared for during this period, which can drastically reduce a child's quality of life if left alone. Thus, symptom checker chatbots may be integrated into various platforms, which can provide proper medication and skin care advice, specifically to young Filipino children. This study presents a symptom checker chatbot that attempts to assist young children in providing clinical impressions regarding specific conditions. The chatbot systematically asks for the symptoms of a child as the child answers yes/no to the questions until the chatbot finally generates the impression on what could possibly be the skin disease that the child may be experiencing. Since the target users are children, the questions of the chatbot were designed to be directed, simple and had included some images to easily understand the symptoms being asked. Nineteen (19) Filipino children aged 8-12 years old had tested the chatbot and answered some questions on the system usability and user experience. Results had shown that the System Usability Scale average score is 87.11% indicating general usability while the mean Functionality score and the mean Performance score are both 98% suggesting that the chatbot had shown good performance and functionality during conversations.

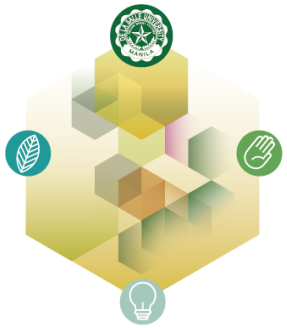
Key Words: Pediatric Healthcare; Skin Diseases in Filipino Children; Chatbot for Health

1. INTRODUCTION

Chatbots are automated computer programs formally designed to converse with human users by mimicking human behavioral patterns in speech (Zhou et al., 2020). The ease at which people can use these systems in their everyday lives has contributed to their growing popularity, culminating in the implementation of chatbots such as "Alexa" from Amazon and Google Assistant (Jovanović et al., 2020). In healthcare, chatbots are commonly called "symptom checker chatbots."

Countries and medical organizations worldwide developed their chatbots to examine the symptoms of the citizens, provide an appropriate diagnosis for possible diseases or disorders, and recommend appropriate measures they can take (Mansab et al., 2021). Furthermore, Arco et al. (2022) developed Ailbot, a symptom checker chatbot that focuses on diagnosing common respiratory diseases among children. There is a precedent that chatbot technology may be able to see more use in the healthcare industry as an accessible way for people to receive medical opinions without needing to consult a healthcare professional physically.

The Philippines has seen its share of common skin diseases such as acne, leprosy, dermatitis, warts, and psoriasis (De Goma & Devaraj, 2020). For instance, in 2017, greater than a third of 5 to 16-year-old Filipino children were diagnosed with chronic skin diseases, such as acne vulgaris (20.2%) and atopic dermatitis (16.5%), and acute skin diseases, such as scabies (12.1%)



(Gonzales-Carait et al., 2020). Through symptom checker chatbots, Filipino children may be provided with an instrument to learn about the disease afflicting them and execute the appropriate care recommendation with the aid of their guardians.

This study aims to develop Ailbot 2.0, a symptom checker chatbot for young children that attempts to provide some impression on skin diseases by asking a systematic series of questions about the symptoms that a child may be experiencing, particularly on the skin. The chatbot prototype had been tested among 19 children with their parents in order to gather some feedback in terms of its useability, performance and functionality.

2. METHODOLOGY

The development and analysis of the chatbot are divided into six sections: Ailments Data, Ailbot 2.0 Design, Ailbot 2.0 Expert Interview and Expert Evaluation, Ailbot 2.0 Development, Ailbot 2.0 Testing Phase, and Data Analysis.

2.1 Chatbot Design and Development

Since this study aims to develop a symptom checker chatbot for skin diseases, it is necessary to study the common skin diseases among Filipino children. Research on the typical symptoms and ten most common skin diseases in the country were conducted through the Department of Health (2012) and peer-reviewed scientific journal articles on the various skin diseases. Additionally, a series of consultations were observed with a nurse educator, a psychiatric nurse, a pediatric nurse, and a midwife.

Ailbot 2.0's conversation flow was patterned on the first Ailbot developed by Arco et al. (2022), a symptom checker for respiratory illnesses that are common among Filipino young children. The conversation flow included the chatbot's potential dialogues and the symptoms and impressions generated by the chatbot. After adapting the conversation flow by Arco et al. (2022), medical professionals reviewed Ailbot 2.0 along with its database and dialogues. Images and drawings were incorporated depicting the symptoms, which were also patterned after the chatbot of Arco et al.

Ailbot 2.0 is developed using Chatfuel, a chatbot-building system that provides a centralized platform for developing AI conversational chatbots. It is a platform for creating chatbots that do not require coding (Chatfuel, n.d.).

2.2. System Evaluation and Testing

Ailbot 2.0 was tested in order to evaluate its capacity to facilitate conversations with children about their possible skin diseases. The details of Ailbot 2.0's Messenger page were sent to the children and their parents or guardians to supervise the task. A short form was then sent to the children to obtain any comments for improvement. After testing, parents or guardians were interviewed for their final opinions.

Consultation interviews among 3 medical professionals in dermatology or pediatrics were also conducted to gather significant and relevant medical information in developing the chatbot. This included the most common skin diseases among Filipino children, their symptoms, and the factors that contribute when diagnosing them. Care recommendations and treatment options for the diseases were also obtained.

Moreover, a second consultation interview was done with 1 medical professional to confirm Ailbot 2.0's authenticity and accuracy by examining the impression, symptoms, and care recommendations generated by the chatbot.

2.3 Data Analysis

A mixed analysis was performed to assess the acquired data from the participants comprehensively. Quantitative data come from the ratings in System Usability Scale (SUS) Questionnaire and the Post-Evaluation Performance and Functionality Level Assessment Survey while the participant's feedback and suggestions, including the information taken from the chat logs, form the qualitative data that may assess Ailbot 2.0's overall usability, functionality, and performance.

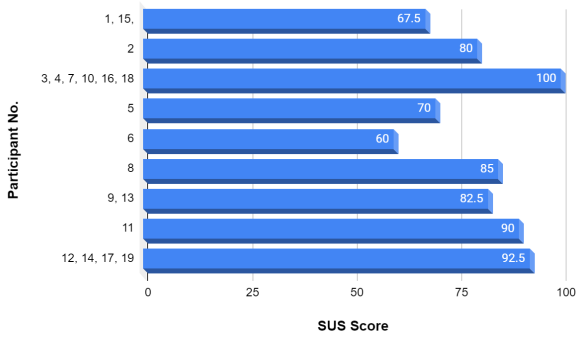
3. RESULTS AND DISCUSSIONS

The System Usability Scale (SUS) Questionnaire was explicitly created to appraise a particular system's usability (Sauro, 2011). This is adapted by Ailbot 2.0 in order to assess the features of

the system. The 5-point Likert scale is utilized for compliance with the standard SUS method of scoring.

From Table 1, the range of the SUS scores (60-100) indicates that there was a broad spectrum of opinions regarding the usability of Ailbot 2.0 among the nineteen (19) participants aged 8-12 years old. The values for the standard deviation (12.94) and the variance (167.54) are higher than average, though they still express that most individual scores are still clustered around the mean SUS score. The average SUS score of the participants (87.11) proves that Ailbot 2.0 is evidently usable to young Filipino children aged 8-12 years old.

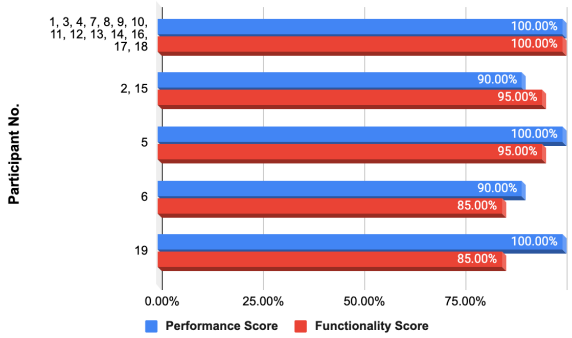
Figure 1 System Usability Scale Scores



The Post-Evaluation Performance and Functionality Level Assessment Survey was designed to evaluate the performance and functionality of the chatbot's responses to the conversation of all the participants. The 5-point Likert scale is also used in both assessments. The participants answered the survey to evaluate the effectiveness and functionality of the chatbot's responses and to gather their input on their interactions with Ailbot. The Performance metric was measured with questions 1 and 2, while the Functionality metric was measured with questions 4 to 6.

The range and average of the Performance (Range: 90%-100%; Average: 98%) and Functionality (Range: 85%-100%; Average: 98%) scores noted in Table 2 suggest that the participants find Ailbot 2.0 well performing in terms of carrying out its functions and purpose. In addition, the standard deviation (Performance: 0.0375; Functionality: 0.0482), and variance (Performance: 0.001; Functionality: 0.002) computed from the Performance and Functionality data reckon that the mean value of both metrics is reliable and within the range of the participants' individual scores, specifying an agreement among the responses of the participants.

Figure 2 Post-Evaluation Performance and Functionality Scores



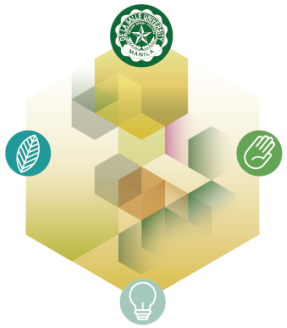
Thematic Analysis

Medical Professionals' Comments and Suggestions

Comments and suggestions were gathered from four medical professionals – a nurse educator and psychiatric nurse, a pediatric nurse, a midwife, and a pediatric doctor in order to gain insights on how to improve the chatbot and ensure the accuracy and correctness of its medical database. Online consultations were conducted via Zoom, and communication was coursed through Messenger.

The medical professionals provided some suggestions on improving the design and scope of the Ailbot 2.0 skin diseases, limiting it to the top ten most common skin diseases in the Philippines' children aged 8-12. Another suggestion is to add photographs appropriate to the age of the children. It was also made clear that it is still recommended for the children with such diseases to seek professional help. The consulted medical professionals suggested proper care recommendations in treating skin diseases, like good hygiene, a healthy diet, and early prevention and control.

Furthermore, some suggestions from the pediatric nurse include adding the demographics and exposure to assess the area in which the child is staying as the appearance of the skin rash, the time it came out,



food intake or exposure to allergens, and other body signs and symptoms that occurred before, during or after the appearance of rashes, and the exposure to other people who may have had an illness are factors which can affect the development of having a skin disease.

Functionality

All of the participant's parents/guardians described that Ailbot 2.0 has successfully done its purpose.

"*...With this technology, it could serve as an easier and more accessible way of receiving preliminary healthcare information.*" – parent of participant 1 (12 years old)

"*The chatbot gave instant and preliminary responses about the medical concerns of my daughter regarding skin diseases and symptoms. "* – parent of participant 3 (12 years old)

Performance

All of the participant's parents/guardians explained that the Ailbot 2.0's performance was well and accurate in diagnosing his/her child.

"*It did a great job in diagnosing my son's condition. My son relayed that the chatbot was easy to understand and that the simple terms and pictures used helped him to further understand what the chatbot was pertaining to.*" – parent of participant 1 (12 years old)

"*Ailbot 2.0 was fully accurate when he diagnosed my child.*" – parent of participant 2 (10 years old)

Participants' Parents' Comments and Suggestions

The parents of the participants did not experience any difficulties with helping their children in communicating with the chatbot.

"*I didn't experience any difficulties since my daughter quickly understood the chatbot's questions.*" – parent of participant 3 (12 years old)

"*I actually did not assist him anymore in answering the chatbot.'* – parent of participant 2 (10 years old)

Moreover, some gave their comments such as by adding incorporating more skin diseases to expand the capability of the chatbot.

"*Indeed, Ailbot 2.0 effectively fulfills its intended function as the chatbot promptly provided immediate and initial replies concerning my daughter's medical inquiries about skin conditions and symptoms. However, I also suggest adding more options for skin diseases to widen the scope. Overall, I am impressed with the functionality and performance of the chatbot as it is a convenient means for children to obtain preliminary medical viewpoints without physically consulting a healthcare professional.*" – parent of participant 3 (12 years old)

Positive feedback was also observed among the parents and children. They were able to commend some features of the Ailbot 2.0 that they found helpful and interesting.

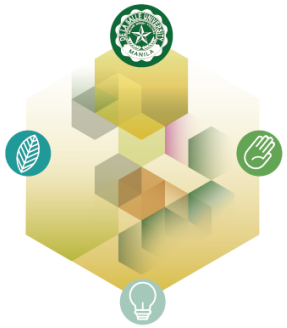
"*We found the feature of asking for our medication and medical conditions helpful."* – parent of participant 2 (10 years old)

"*...realistic images of skin diseases were helpful.*" – parent of participant 3 (12 years old)

Furthermore, some gave their suggestions during the interview such as by making it more user-friendly and making the responses more human-like to help make the conversation more engaging.

"*I would like to suggest to further making Ailbot 2.0 more user-friendly by making the conversation of the chatbot more interactive and engaging. Incorporate humor, empathy, or personalization elements in the chatbot's responses to create a friendlier, more human-like interaction with the children. Also, visual cues can enhance the user experience and make interactions more intuitive, particularly with voice-based chatbots. With multiple communication channels, such as other mobile apps. messaging platforms, or voice assistants, allowing users to interact with the chatbot through their preferred media, improving accessibility and convenience.*" – parent of participant 3 (12 years old)

"*...This would help further as it could keep the children's interest and help them keep their focus on engaging with the chatbot, which could lead to a more accurate diagnosis.*" – parent of participant 1 (12 years old)



Lastly, the parents commend the conversational flow of the chatbot which led to the correct diagnosis/impressions.

"*The chatbot asked the correct questions, leading to an accurate diagnosis/impression. Ailbot 2.0 effectively fulfills its intended function as the chatbot promptly provided immediate and initial replies concerning my daughter's medical inquiries about skin conditions and symptoms… the chatbot also provided tips and advice to stop the itchiness and pain when encountering a specific type of disease.*" – parent of participant 3 (12 years old)

4. CONCLUSION

Limited access to healthcare has been a problem in the Philippines, heightened with the COVID-19 pandemic. This study aimed to develop a symptom checker chatbot for Filipino children by incorporating different common skin diseases: scabies, chickenpox, measles skin rash, ringworm, atopic dermatitis, urticaria (hives), prickly heat, tinea versicolor, psoriasis, and warts. 19 Filipino children aged 8 to 12 years old were asked to converse with the chatbot and answer some survey questions about Ailbot 2.0's usability, performance, and functionality. The average SUS score obtained was 87.11, the mean Functionality score was 98%, and the mean Performance score was also 98%. However, individual scores still varied immensely, expressing different difficulties encountered by the respondents. The results suggest that Ailbot 2.0 is capable of conversing with children through the use of simplified language, the application of "emojis", and the presence of images. However, the conversation can be improved by accepting answers that are not necessarily yes or no, or more probing questions that are related to a particular symptom. Nevertheless, the Ailbot 2.0 chatbot was not intended to replace medical professionals. It is not intended to substitute the diagnoses made by medical professionals. The contribution of this work attempts to have a better interface by adding pictures and providing care treatments based on the diagnosed ailments so that the interaction will be more child-friendly and symptoms can easily be understood by young children. Future enhancements to the system are strongly suggested, such as by incorporating other diseases since only the ten most common skin diseases were included in the Ailbot 2.0, visual cues, audio-based conversations, humor, empathy, and other personalization elements in the chatbot's responses to create a friendlier, more human-like interaction with the children.

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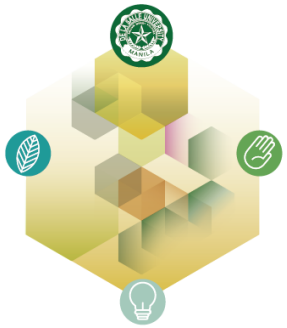

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