Raising Awareness on Deague Virus: The AEDES Chatbot

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Abstract

Malaysian health reports have shown that dengue cases remain in trend in 2020amidst the pandemic of Covid-19. Several expert systems have been proposed to provide expert knowledge as well as diagnosis to dengue symptoms. This paper explores the use of conversational platform using chatbots to enhance the expert systems by offering a natural and an intuitive information delivery method using natural language. By incorporating the concept of intelligent agent, acquiring information becomes more interactive and interesting. The proposed chatbot is hoped to raise awareness on the symptoms, impact, and prevention of the dengue virus among the public.

1   Introduction

Among the problems affecting the dengue outbreak, Malaysian climate is the major contributor to the spread of the dengue virus. The climate of Malaysia is categorized as hot and humid with an average temperature of 27°C to 32°C throughout the year, which is the ideal temperature range for the survival of aedes mosquitoes [1]. According to [2], increased reproduction of aedes mosquitoes is due to warmer temperatures, hence an increasing capacity to produce aedes' offspring [3, 4].

Improper management of the environment adds to the increase of aedes breeding. Due to the lack of environmental management among both Malaysian citizens or the government,

the housing areas become the most favorable breeding place for the aedes mosquitoes. For instance, tires, flowerpots, or any other storage containers can easily be filled with water especially after the rain. Worse, clogged drains along the street, if are not handled with proper management can also be a desirable place for mosquito breeding. These scenario adds more risk to Malaysian as the country has high rainfall and humidity, therefore is prone to the outbreak of dengue fever. As shown in Figure 1, press release by the Ministry of Health Malaysia dated 8 June 2020 reported the increase of dengue fever cases by 8% every week. 11% from death cases were due to late treatment, which should begin as soon as three days of the first symptoms. Apart from high fever, the most common symptoms of dengue fever includes nausea, vomiting, rashes, aches, and pains (typically behind the eyes, muscle, joint, or bone pain). Severe dengue fever can escalate to induce abdominal pain, vomiting, pleural effusion, tender liver, irritable, lethargy, and bleeding from nose or gums.
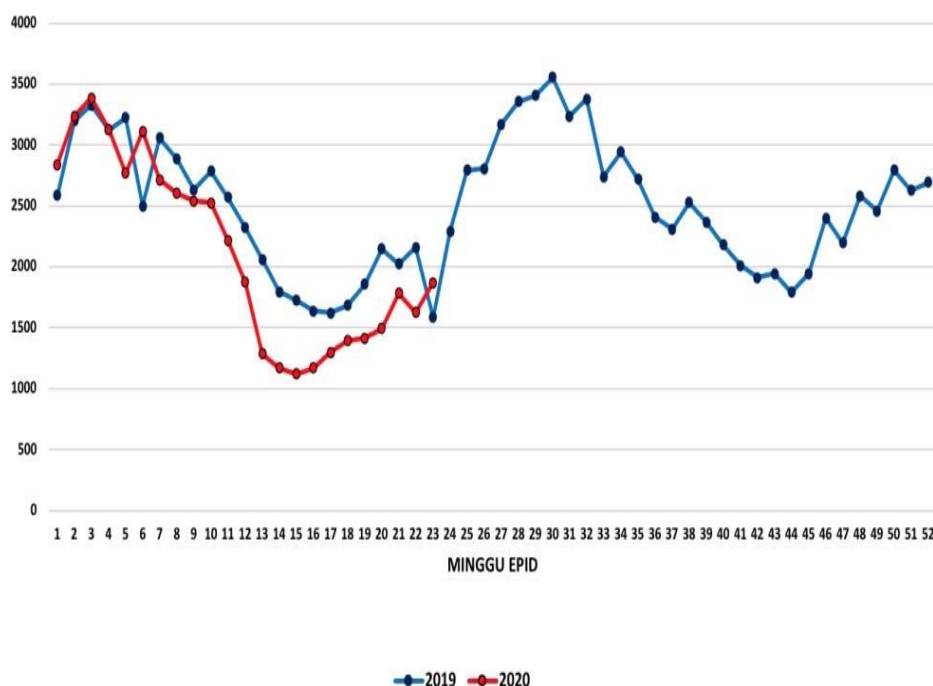

Fig. 1. *Dengue fever weekly trend 2019-2020 (week vs. cases), Department of Health Malaysia*

Nonetheless, the public pays very little attention to the symptoms of dengue fever and is mostly ignorant of the consequences of severe dengue. Deadly cases can be reduced if the dengue fever is treated on time. To promote awareness to the public, this paper explore the conversational platform of a chatbot that simulate a role of an expert system on dengue- related information. Chatbots, being able to converse with public in natural language, provides a natural and intuitive information delivery methods to the mass [5, 6]. Medical assistant chatbots have been previously explored in literature such as by [7, 8, 9, 10]. Specifically for dengue, [11] used Artificial Intelligence (AI)-based diagnostic screening for dengue fever and [12] developed a mobile application based on expert system to aid in the diagnosis of dengue, zika, and chikungunya.

The remaining of this paper proceeds as follows. Section 2 presents the proposed chatbot called Aedes, along with its design and prototype. Section 3 presents the evaluation results, and finally Section 4 concludes the paper.

2   Materials And Method

This paper proposes implementation of dengue virus expert system on a conversational platform called Aedes. This section will present the knowledge base, design, and prototype interface of the Aedes chatbot.

2.1   Knowledge Base

The knowledge base for Aedes chatbot is organized around four topics, which are (1) Vector of Dengue Disease, (2) Cause of Dengue Disease, (3) Symptom of Dengue Disease, and (4) Treatment of Dengue Disease. Figure 2 shows partial knowledge representation covered by the Aedes chatbot.

The first topic explores common characteristics of Aedes mosquitoes such as their environment and breeding grounds. The second topic explains the dengue virus transmission chain, which begins from an infected Aedes mosquito biting a normal person and the virus is transmitted through the bite. This topic also educate that an infected person develops immunity after recovery, but for a specific strain of virus only. The third topic explains on the symptoms that a person will exhibit once infected with the dengue virus. The symptoms are categorized based on normal fever or severe fever.
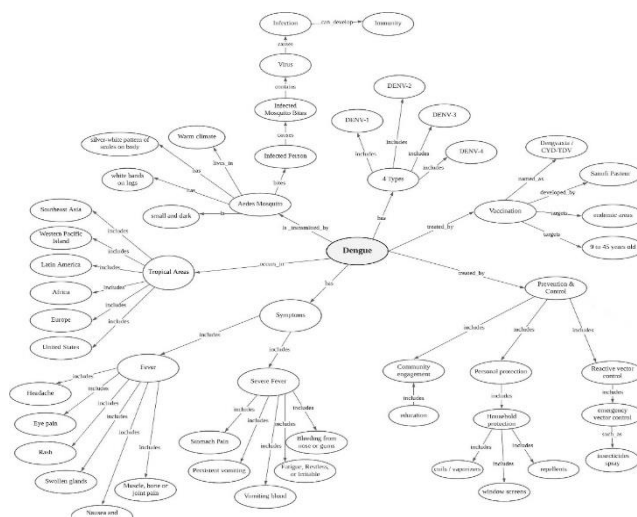

Figure 2. *Knowledge representation of the Aedes chatbot.*

The third topic also includes other common symptoms such as rash, pain, nausea, and vomiting that might come along with the fever. Finally, the fourth topic talks about the dengue prevention such as using insecticides to kill Aedes mosquitoes and vaccination.

2.2   Design

Figure 3 shows the general architecture of Aedes chatbot. Aedes relies on two main components, which are the dialogue interface and the knowledge base. More documentations can be assesed from https://cloud.google.com/dialogflow/docs.

The Aedes chatbot is developed using the DialogFlow [13]. DialogFlow is a design tool to develop a conversational user interface in stand-alone, mobile or web applications. It provides methods to analyze input and respond to users via its natural language understanding capability.
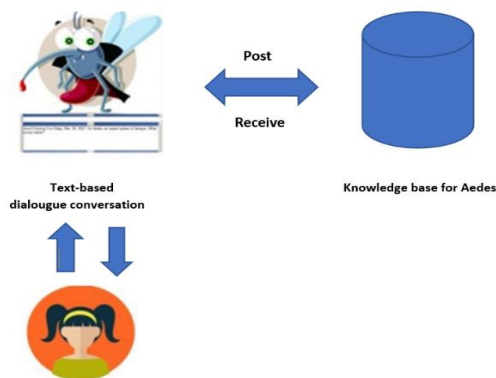
Figure 3. *General architecture of Aedes chatbot.*

2.3   Prototype Interface

Figure 4 shows the main user interface for the Aedes chatbot. The interface relies heavily on the dialogue panel that allows users to key-in their input and the chatbot to display its own input. A single session of conversation is then stored in a flat text logfile by the chatbot.

Hello Jane. Nice to meet you!
How can I help you today? Let's start off by knowing more on dengue!
Enter "dengue" to check it out!

Figure 4. *Main user interface of Aedes chatbot.*

Figure 5 shows sample conversation in quizzes. Each of the topic is also associated with different set of quiz. The questions for quizzes revolves around general knowledge such as the ability of a dengue patient to develop immunity after recovery, different types of dengue disesase that exist or whether dengue is transmitted by a specific mosquito only.

Perfect! Repellents DO kills the Aedes.

Now, second question: Will cleaning containers filled with water help preventing Dengue? (Yes or No)

Figure 5. *Sample conversation on quiz.*

3   Evaluation

A questionnaire survey is conducted to collect the feedback on the Aedes chatbot developed. There were a total of 5 questions with ratings from 1 to 3, ranging from disagree to agree. An analysis of the user acceptance test results was performed after gathering the feedback from 20 random respondents. The questions are as follows:

- Q1: Is Aedes chatbot user-friendly and interactive?
- Q2: Can Aedes chatbot answer your questions regarding dengue disease?
- Q3: Does Aedes chatbot guide you through the process of understanding dengue disease?
- Q4: Does Aedes chatbot help you in increasing awareness level regarding the dengue disease?
- Q5: Do you think the information listed in Aedes chatbot is complete and sufficient to educate the public?

Figure 6 shows the results for Question 1. Based on the graph, it can be concluded that 70% of the respondents find Aedes chatbot user-friendly, 5% of the respondents disagree with the statement whereas the remaining 25% is holding a neutral opinion. This results showed that most users are satisfied with the Aedes chatbot and think it is easy to communicate and interact. However, further improvements can be done to make the chatbot more human-like in order to give users the experience of communicating with real humans during the interaction.
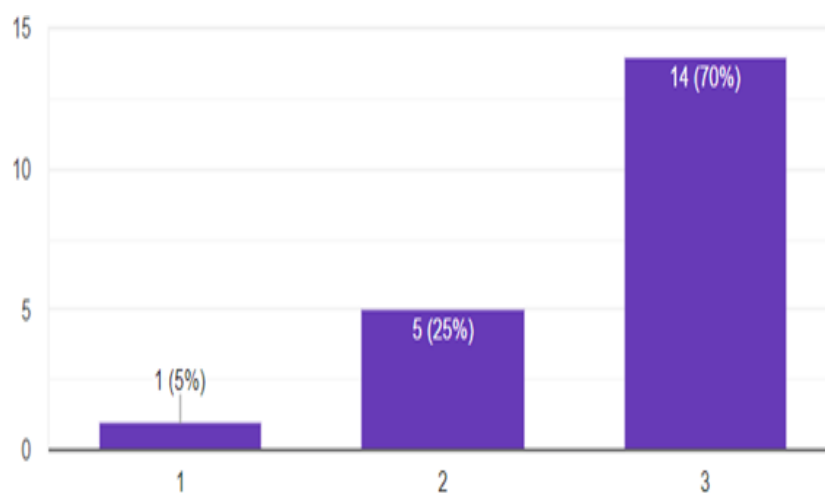

Figure. 6. *Is Aedes chatbot user-friendly and interactive?*

Figure 7 shows the results for Question 2. Based on the graph, the Aedes chatbot has shown capacity of answering the questions on dengue disease for 65% of the respondents. However, 35% of the respondents do not really think that the Aedes chatbot has solved their questions clearly. The Aedes chatbot is able to answer the questions asked by major users. However, there will be some occasions when the Aedes chatbot fails to clarify the questions clearly and the users may not realize that their questions have been answered indirectly.
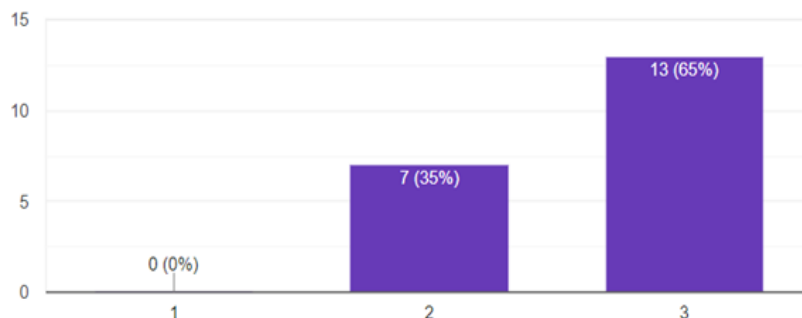
Figure. 7. *Can Aedes chatbot answer your questions regarding dengue disease?*

Figure 8 shows the results for Question 3. The graph shows that 70% of the respondents agree that the Aedes chatbot has guided them through the whole process of learning dengue disease. The remaining 30% holds a neutral opinion on the matter. The results showed that the Aedes chatbot has successfully acted as a guide to lead the users through the learning process of dengue disease. The users do not feel confused and lost when using the chatbot as the chatbot will guide the users step-by-step through the whole process. Hints will be given as well.
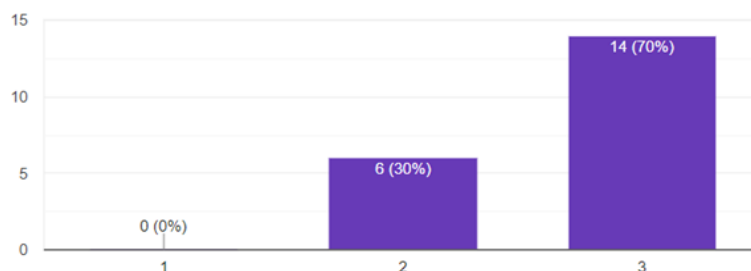

Figure 8. *Does Aedes chatbot guide you through the process of understanding dengue disease?*

Figure 9 shows the results for Question 4. The graph shows that 50% of the respondents have experienced increases in awareness level on dengue whereas 5% of the respondents hold the opposition. The remaining 45% of the respondents hold a neutral opinion. Even though the majority of the users have proven to be experiencing increasing in awareness level on dengue, it is still insufficient as the chatbot is expected to impact more people in order to reduce the dengue impact effectively. Hence, more content will be included in the Aedes chatbot, such as the negative impact of dengue, to educate the public.
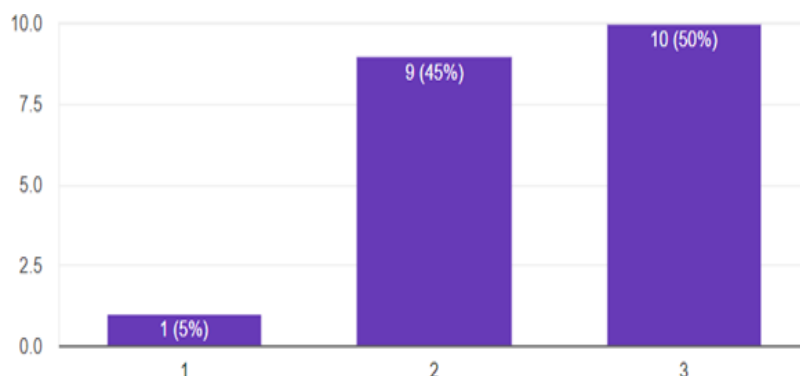

Figure 9. *Does Aedes chatbot help you in increasing awareness level regarding the dengue disease?*

Figure 10 shows the results for Question 5. Based on the graph, 75% of the respondents hold a positive opinion on the statement whereas 5% of the respondents think that the content of the chatbot can be improved further. 20% of the respondents hold a neutral opinion. According to the users' feedback, it can be concluded that the users are satisfied with the contents in the Aedes chatbot. However, the chatbot can be further improved by adding additional information to provide knowledge from all perspectives. As a start, the Aedes chatbot can be seen an effective to reach the new generation and raise awareness of risks of dengue while promoting clean environment.
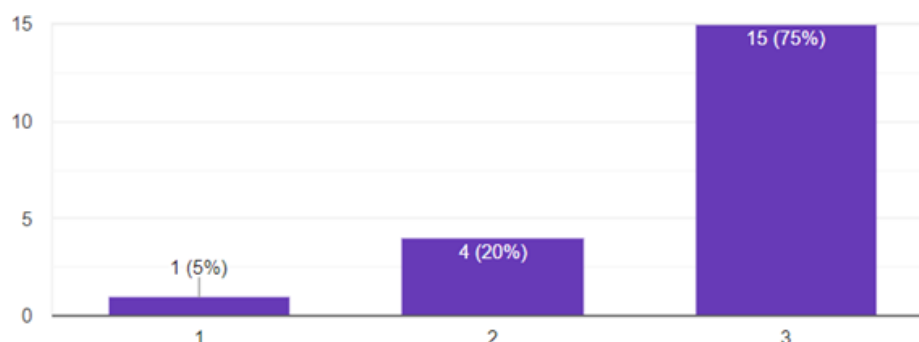

Figure 10. *Do you think the information listed in Aedes chatbot is complete and sufficient to educate the public?*

4   Conclusion

This paper proposed a conversational platform to an Aedes expert system, which called the Aedes chatbot. The conversational ability provides a natural and intuitive interface to users in raising awareness on dengue virus and disease. It also attracts different age groups as the information are relayed in a dialogue form rather than reading a full-length article. User Acceptance Test via questionnaire survey involving 20 respondents, which provided a favorable response. The Aedes chatbot is hoped to continue promoting awareness on dengue even in the amidst of Covid-19 pandemic.

Acknowledgments

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