Insecto-Aid: An Augmented Reality Mobile Application on Entomophobia Treatment

An AR Mobile Application on Entomophobia Treatment

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***Abstract*— Entomophobia is a fear of insects that is abnormal and persistent. People who suffer from entomophobia are generally aware that being terrified of something that represents no threat is nonsensical, but they have no control over it. Exposure therapy, Cognitive behavioral therapy (CBT), and medicines have all been used to treat entomophobia. In Malaysia, entomophobia is not as prevalent as it is in the United States. Malaysians are no strangers to insects and bugs, as we are surrounded by rainforests and jungles. Malaysians, unfortunately, suffer from this special anxiety. It is simply not discussed as much as other phobias. Fear of insects may be amusing to some, but it has serious consequences for those who suffer from it. The goal of this research is to introduce an augmented reality (AR) mobile application as an alternative therapy treatment for people who suffer from entomophobia. The software is designed to give users a taste of both the real world and augmented insects as a treatment before they have to deal with them in a real-life situation. It is envisaged that this mobile application will be an effective alternative tool in the treatment of entomophobia by ensuring a secure environment in which the scenario can be regulated by the user and thereby focusing on entomophobia awareness. The waterfall model was chosen as the primary methodology for creating the Augmented Reality mobile app.**

Keywords*— Entomophobia, Insects, Augmented reality, Mobile Application, Awareness.

I. INTRODUCTION

Recent augmented reality statistics provide insight into various advances and applications of AR not only in gaming but also in other industries such as healthcare, education, manufacturing, and retail [1]. It is estimated that 68.7 million people utilize augmented reality at least once a month around the world. The insertion of virtual material in the real world to function in the same representation and enhance the sensory experience of reality by the individual in real time is known as augmented reality (AR). It allows users to see the physical world by fusing virtual and real-life objects. According to studies, the lifelong universality of individual phobias varies between 3% and 15% over the world, with the most prevalent fears and phobias being animals and heights. Entomophobia, also known as Acarophobia or Insectophobia, is a condition in which people are terrified of insects. Entomophobia is a phobia that is defined by the DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition) as an unreasonable or excessive fear of one or more groups of insects. Spiders, ants, cockroaches, bees, centipedes, beetles, and other bugs are among the phobias. Individuals who are entomophobic may experience an itch or a crawling sensation all over or under their skin [2].

People who suffer from entomophobia are unlikely to be cured immediately because the fear is most likely to develop during childhood, while it is possible to develop the phobia later in life. Some people have moderate reactions, while others may be unable to leave the house for fear of being bitten by an insect [3]. Treatments such as exposure therapy can take a long time to work, and there are a variety of conditions that could put the sufferer in risk. A therapist can never predict how an entomophobic patient will respond when confronted with a live insect. Both parties may be in danger as a result of the scenario. By incorporating Augmented Reality into the treatment, users will be provided with a safer atmosphere in which to overcome their concerns. Aside from that, understanding of insect fear, or entomophobia, is still limited in Malaysian society. People are unaware of how severely it can affect a specific individual. Extreme aversion to insects does exist, and if left untreated, it can have serious implications.

The research objective of this research is:

- To analyze the practicability of using AR as an alternative method in treating entomophobia
- To develop an augmented reality mobile application as an alternative treatment for people with entomophobia.
- To evaluate the effectiveness of a treatment method by using Augmented Reality (AR).

The research question is:

- What is the difference between Augmented Reality (AR) and Virtual Reality (VR)?
- How will Augmented Reality help in treating Entomophobia?
- What is the level of awareness on Entomophobia in Malaysia?

II. LITERATURE REVIEW

Augmented reality (AR) is a technology that superimposes a user's perspective of the real world over a computer-generated image, providing the user with additional information provided by the computer model. AR is a supplement to reality; it does not, however, totally replace it. In fact, it's a hybrid of the real world and a virtual object that's superimposed over a real-world setting [4]. This helps users to improve their view of the real world and their interactions with it. The added virtual item contains information that the user cannot see directly with his or her own eyes, but which allows the user to accomplish actions in the actual world indirectly [5]. Virtual Reality, on the other hand, entails a total immersion experience that isolates the user from the outside world. The VR system works by immersing the user in a synthetic environment in which the entire situation is managed for their enjoyment. VR creates a virtual world that is dynamic and responds to the user's interaction (gestures, verbal commands, etc) [6]. People are enthralled by stimulation that responds to their commands on a computer screen. AR has taken a different path than VR, yet there are differences between the two. Rather of relying on a fictional universe, it depends on technology to improve a real facet of life [7].

A. What is Entomophobia?

Entomophobia is a type of phobia that is classed as a particular phobia. It is defined as a strong aversion to insects. A specific phobia is characterized by a strong, recurring fear of a specific object or situation that is out of proportion to the real danger. The physical symptoms of entomophobia are similar to those of other phobias, including anxiety, shortness of breath, nausea, panic attacks, and chest tightness. Other key mental and emotional symptoms of entomophobia include an instantaneous feeling of severe fear and anxiety when thinking about an insect, an increase in anxiety as the insect approaches, and difficulty focusing or working on the insect's concept. These symptoms frequently have an impact on and interfere with their daily activities. Experts have never been able to pinpoint the exact causes of entomophobia [8]. It could be due to certain circumstances, such as age, that raise the risk. “Temperament can also make you more susceptible to develop a phobia, such as being more negative or sensitive,” according to the Mayo Clinic on specific phobia. There are several potential reasons of entomophobia, such as a traumatic or unpleasant event, that might lead to the development of phobias. A centipede may have stung you as a child, or a bug on your arm may have scared you awake. Aside from that, fear of contamination, fear of being poisoned or bitten, and psychological issues can all contribute to this phobia. According to a study of the psychological impacts of entomophobia on school-aged children, having enough bug information will significantly diminish the student's unjustified fear and phobia [9]. It is explained that those who suffer from entomophobia are often afraid of insects because of their looks rather than the nature of their repercussions. For example, if a cockroach infestation occurs in a home, it serves as a subliminal reminder that the home is unsanitary. Aside from that, a fear of insects can emerge as a result of others' perceptions of them. Consider seeing a film that presents insects in a negative light. Phobia can also be passed down or inherited in part from one parent to the next. This can arise as a result of a combination of genes and other acquired behaviors. Learned behavior occurs when a person observes another person's phobia and acquires a comparable phobia inside himself [10]. There have been numerous approaches to treating this phobia, as well as other specific phobias. It could comprise a variety of ways. It is treatable, but it takes time and effort on the part of those who suffer from it. It is strongly advised that people with severe entomophobia visit a doctor.

B. Augmented Reality in Healthcare

The usage of virtual reality technology in the healthcare sector is bringing up new possibilities. The benefits of augmented reality technology have been well-understood by healthcare professionals. Furthermore, education is an obvious application of augmented reality in the healthcare field. By the year 2020, global demand is estimated to reach $1.5 billion. New breakthroughs in AR will help doctors and surgeons diagnose, treat, and perform surgery on their patients more successfully than ever before by providing them with faster and more precise access to real-time data and patient information. AR is quickly becoming one of our society's most popular debate subjects, as well as a leading arena for all new types of medical applications [11]. According to studies, AR technologies have begun to mature the field of anatomical and physiological teaching [12]. The advantages of augmented reality, on the other hand, are not limited to healthcare workers. It has been shown to be quite beneficial as a platform for patient education and allowing medical practitioners to assist patients in better understanding medical procedures.

C. Augmented Reality in Treating Insect Phobia

According to one study, augmented reality (AR) could be utilized to treat psychological disorders. When compared to standard treatment, using AR for this treatment has some advantages [13]. Figure I depict the benefits of AR over traditional treatment for psychiatric disorders.

TABLE I. COMPARISON OF TRADITIONA TREATMENT AND AR TREATMENT

Traditional Treatment	***AR Treatment***
The situation cannot be controlled by therapist	The situation can be controlled
The element of the therapy is real (insects) and a safe treatment cannot be promised	Virtual elements are not real, which means that there is no real danger
The place and session might be done in places that the sufferers fear to recreate their fear. By this, the places might be complicated and requires several sessions.	Treatment can be done anywhere. Access to the scene is as easy as running the program.

AR has shown to be a safe tool for persons with specific phobias since it allows them to easily expose themselves to objects without having to program whole virtual environments [14]. To be classified as AR, a system must have a mix of real and virtual things in a real world, second, the system must be interactive and register in real time, and third, the system must arrange real and virtual things next to each other [15].

The usefulness of AR in the treatment of phobias has long been known. The first to publish a report titled "Mixing Realities?" that uses an Augmented Reality Application for the Treatment of Cockroach Phobia to ARET (Augmented Reality Exposure Treatment) for the treatment of a specific phobia. According to the study, utilizing the one-session treatment instructions of Öst et al., they successfully treated a participant with small animal phobia (cockroach) classified under the DSM-IV (American Psychiatric Association, 2000). A month following the treatment, the results were examined in a follow-up. The subject may be seen killing a live cockroach, which appears to be a positive response to the treatment. While the results of this study were promising, the authors believe that a bigger sample size is required to obtain a clear outcome. Nonetheless, the author added that the important question is whether by using these AR systems, which have the advantage of providing additional information to the user in modifying a more efficient and effective way of the pathological fear structures than what can be accomplished with current psychological treatments, the important question is whether by using these AR systems, which have the advantage of allowing the provision of additional information to the user in modifying a more efficient and effective way of the pathological fear structures than what can be accomplished with current psychological treatments [5].

A study with nine subjects who have all been diagnosed with particular phobia according to DSM-IV criteria (specifically, fear of cockroaches and spiders). The first ARET approach involves increasing the number of insects in a simple exposure. Second, by increasing the number of insects with your hand and then peeking under four boxes to uncover the insect that you are afraid of. Finally, by watching how the therapist interacts with the insects by repeatedly smashing them with a flyswatter, they can accomplish it on their own. The findings could indicate that the AR system was able to reduce fear in persons who were afraid of spiders or cockroaches. In any case, the approach has been demonstrated to effectively reduce participant anxiety while also confusing the insects. Following the completion of the therapy, all of the patients were able to face live insects, interact with them, and even kill them. The authors also claimed that their findings support the use of AR technology in the treatment of phobia, but that future research would need to include a much bigger sample size and groups in order to get better outcomes. As a result, such a procedure will boost trust in this new exposure strategy [13].

Most of the prior research employing AR as an effective treatment approach for insect phobia have shown success. Though it has not been demonstrated to completely cure the phobia, it has assisted in overcoming fear in a safer atmosphere.

III. METHODOLOGY

The systematic, theoretical analysis of the procedures used in a field of research is known as methodology. In other words, methodology can be defined as the process of explaining design decisions by demonstrating which methodologies and approaches best fit the study goals and objectives while producing trustworthy and accurate results. The phases of research methodology are requirement, analysis, design, implementation, and evaluation. The Waterfall model methodology was employed in this project. This strategy was chosen because it is the most appropriate for completing this project.

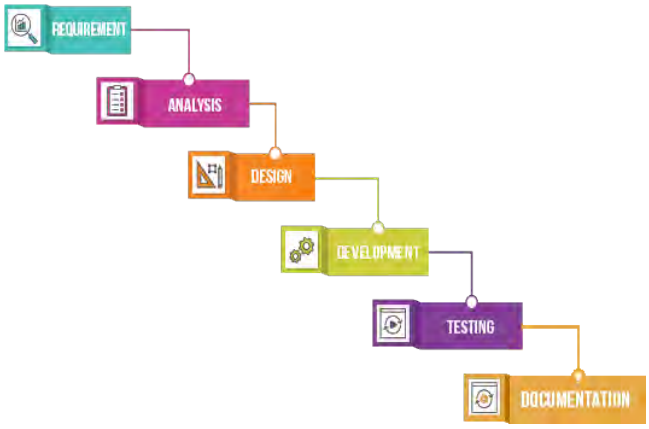

Fig. 1. Waterfall Model

A. Requirement

Identifying the appropriate and compatible hardware and software is one of the requirements for developing this project. This ensures that the application will function properly. Unity 3D is the most commonly used tool for creating a health augmented reality smartphone application. For 3D modeling, however, Autodesk 3Ds Max software is used.

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B. Analysis

The "Goal-Setting" step can be considered the analyzing phase. It also refers to whether or not the project's goal and target audiences are aligned. Aside from that, it also includes data collection on Entomophobia. Choosing the suitable equipment, method, and software to be used during the analysis phase is necessary to ensure the application's smooth operation.

In terms of the function, the expectation is to be determined. The findings are documented at the end of the analysis process. As a result, once the data has been gathered, an analysis must be conducted. The problem statement or improvement must be detailed in the analysis. The results of this research will be used in the design phase.

C. Design

The design phase is a crucial part of the waterfall model since it incorporates the results of the analysis phase. The content, user interface, subject matter analysis, and media selection are all part of this step. Creating a visual portrayal of the program (storyboard), designing the user interface, and content are examples of tactics for developing the app systematically and particularly to meet the specified goals.

D. Development/Implementation

This development step entails converting the design phase into a functional application. Both the development and coding of the mobile application. During the implementation phase, however, measures such as extensive testing and completion of the appropriate documentation are required. 3D models developed in 3ds Max will be imported into Unity before being used in the mobile app. The Google Pixel 3XL was utilized to deliver the project application.

E. Testing

This step entailed assessing the application's functioning in respect to the desired outcome. During this phase, the AR mobile application is evaluated to see if it satisfies the project's objectives in terms of functionality. The testing procedure encompasses all components of the mobile application, from buttons to AR features. This is to ensure that the entire program runs smoothly and efficiently. User Acceptance Tests will be conducted to gather input from users on the application.

F. Documentation

This is the stage in which the results are analyzed. The information acquired during the previous phases will be saved. As a result, based on the data supplied, findings and recommendations will be reported.

IV. PROTOTYPE DEVELOPMENT

The development phase of the Insecto-Aid application prototype is detailed in this chapter of the study. The project timeline, flowchart, application site map/navigation, interface design, 3D models, book, and sticker designs are all included. Aside from that, this chapter concentrates on the project's anticipated limits during development.

A. Site Map/Navigation

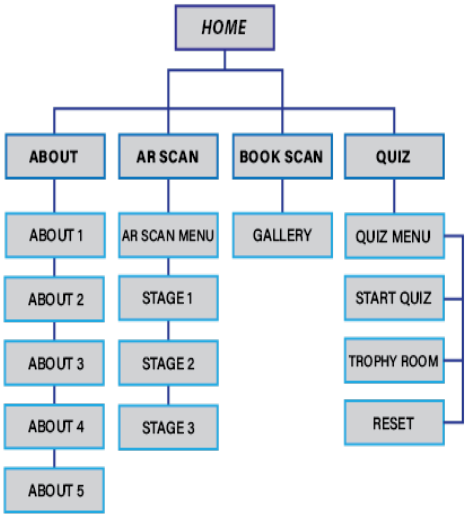

Fig. 2. Site Map of Insecto-Aid mobile application

For both designers and non-designers, a sitemap can be a useful planning tool. It's a centralized planning tool for organizing and clarifying the content that needs to be on the app, as well as removing unnecessary pages.

B. Interface Design

The visual layout of the application with which the user will interact is referred to as interface design. When users are using the app, it is specially created to be appealing and eye-catching. To create a well-structured mobile application, the content of each page was determined ahead of time.

Fig. 3. Main menu and Treatment menu of the Insecto-Aid app

Fig. 4. AR treatment page in the Insecto-Aid application

User will need to choose the feared insect and it will direct them to the stage 1 page. Fig. 4 shows the stage 1 page. As stated in the book's instruction manual, a sticker of the chosen insect must be placed on the hand to serve as a target marker for the therapy to begin. The user must tap to start the timer when the 3D insect appears. The timer button is a bright red hue so that the user can see it easily. When the timer goes off, the treatment is finished, and the user can move on to Stages 2 and 3.

- Buttons

A button is a graphical control component that allows the user to quickly conduct an action, such as searching for a question in a search engine, or communicate with dialog boxes, such as verifying an action. To provide a consistent design for the Insecto-Aid mobile application, all the buttons are developed in Adobe Illustrator beforehand.

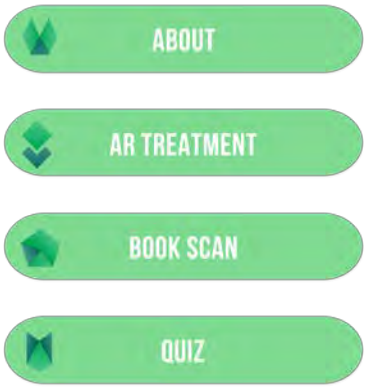

Fig. 5. Main Menu Buttons

Fig. 6. Icon Buttons in Insecto-Aid application

- Fonts Standardization

A typeface is a collection of written characters that can be displayed or printed in a specific style and scale. The type of font chosen in a mobile application is critical since it must be clear and readable for users. Typography expresses the app's qualities and personality in the same way that color communicates the app's personality. As a result, selecting the appropriate font is critical when creating a mobile application, as each type and style of font communicates something different to the user.

Fig. 7. Font selection

- Color Scheme

Colors have a lot of power when applied effectively. The color palette you select can either complement or detract from the overall design. The colors employed in the design make up a color scheme. They're employed to give a touch of whimsy and attractiveness, as well as to convey a certain atmosphere. The main color scheme of the Insecto-Aid mobile application is blue and green. This is done to keep the visual depiction as simple as possible.

Fig. 8. Final Color Scheme

C. 3D Model

3Ds max 2020 was used to create the insect 3D models utilized in the Insecto-Aid smartphone application. The creation of 3D models and animation required the most time of all the tasks in this project. A great deal of care has gone into creating a realistic-looking insect so that the user may fully appreciate the augmented reality features. Adobe Photoshop was used to create the materials and textures. When 3D models and animations are

finished rendering, they are exported to FBX format and imported into Unity.

Fig. 9. Cockroach model in 3Ds Max and texture image

D. Book Design

The Insecto-Aid book offers thorough information on entomophobia and is designed to be used as a target marker. The book's color scheme was chosen to match that of the application. Figure 4.27 depicts the book's front page, which is intended to be simple. The book is custom size, meaning it is smaller than A2.

Fig. 10. Front page design of the book

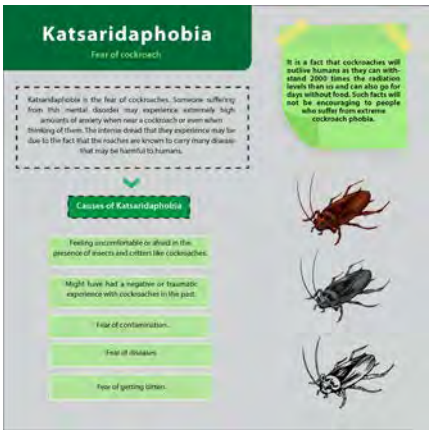

Fig. 11. Book information design

- Sticker Design

The Insecto-Aid book includes a sticker. It serves as the application's target marker for the AR Treatment page. Each insect has its own color as well as an icon. To begin AR treatment in the Insecto-Aid application, the user must paste the sticker on the hand.

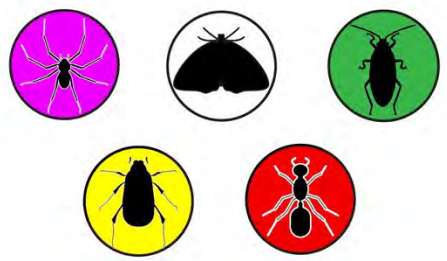

Fig. 12. Sticker design

V. RESULT AND DISCUSSION

People who have an irrational phobia of insects are the target audience for the Insecto-Aid Augmented Reality Mobile Application. This is because the application must be examined in order to determine its effectiveness and whether the defined objectives were reached successfully. Twenty respondents tried out the Insecto-Aid app in person with the developer, while another 25 were given the APK file to download and use at home. The Insecto-Aid smartphone application has been successfully tested by 45 people.

A. Section A: Personal Information

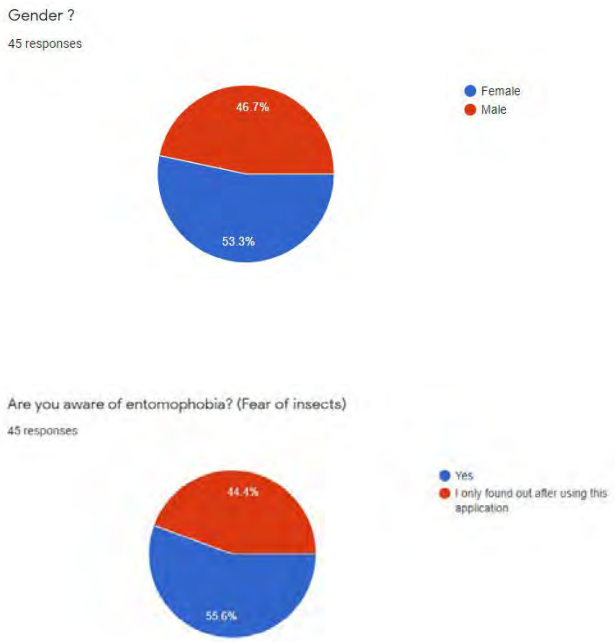

Fig. 13. Demographic result

Section A results show that 45 people completed the questionnaire, with 53.3 percent (24) of them being girls and 46.7 percent (21) being males. The findings of this study are similar to those found in the literature. While there was no significant link between age and fear in this study, there was a link between gender and fear, with females having a higher prevalence than males. As previously indicated, 20 of the 45 respondents tried the Insecto-Aid application in person with the developer. 15 of the 20 respondents were females who were terrified of insects. 73.3 percent of the responders are between the ages of 21 and 30. 13.3% of those polled are between the ages of 31 and 39, 13.4% are between the ages of 16 and 20, and 13.4% are between the ages of 40 and 50. The majority (55.6%) say they are aware of entomophobia, and 44.4 percent say they just discovered it after using the Insecto-Aid smartphone app. The results suggest that 20 of the 45 respondents were only aware of entomophobia after utilizing the Insecto-Aid mobile app. One of the goals of designing the app is to raise awareness about entomophobia in Malaysia.

B. *Section B: User Interface and User Experience on Insecto-Aid application*

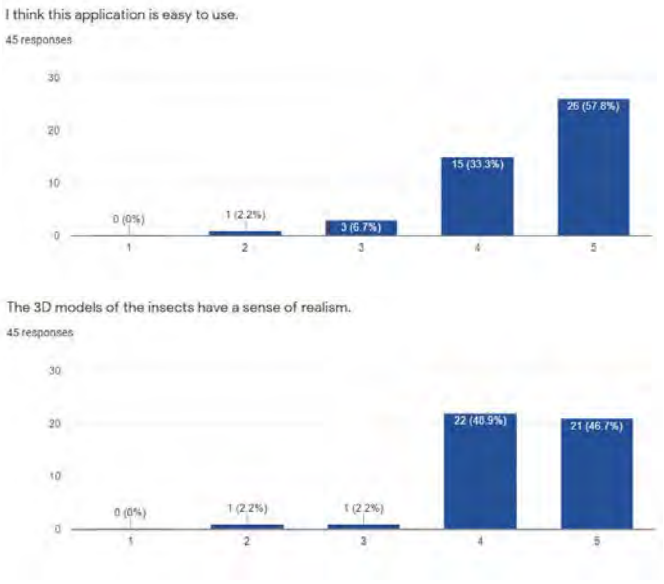

Fig. 14. UI and UE on Insecto Aid app

According to figure 14, 26 of the respondents (57.8%) highly agree and 15 (33.3%) agree that the application is uncomplicated to use. Only three respondents (6.7 percent) are neutral, and one respondent (2.2 percent) disagrees that the application is easy to use. This could be due to a lack of familiarity with the AR mobile app. Aside from that, 21 respondents (46.7 percent) highly agree, and 22 respondents (48.9%) agree that the 3D models of the insects have a sense of realism, according to 45 respondents. The production of 3D model insects is crucial in the development of Insecto-Aid, since it is the major goal of the AR mobile application. As a result, the vast majority of respondents believe that the 3D models of insects in the Insecto-Aid app are realistic, with only one respondent (2.2%) disagreeing.

C. *Section C: The Effectiveness of Insecto-Aid application.*

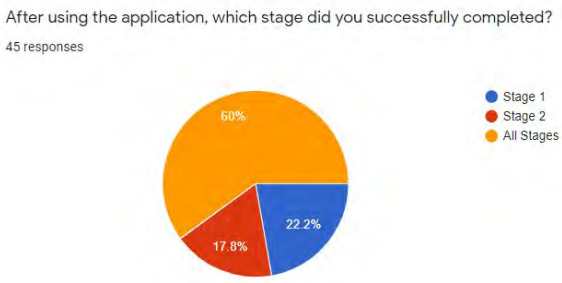

Fig. 15. Result of the Insecto-Aid treatment

The results of respondents after utilizing the Insecto-Aid treatment are shown in Figure 15. Users will go through three stages to complete the AR therapy, as indicated in Chapter 4. This section of the questionnaire covers information relevant to one of the research's goals, which is to develop and evaluate an augmented reality mobile application as an alternative treatment for people suffering from entomophobia. Figure 15 shows that 60 percent of 45 responders successfully complete all three rounds of the Insecto-Aid app. 22.2 percent of responders, on the other hand, simply made it through the first step and were unable to continue. Furthermore, 17.8% of respondents were able to get to stage 2 but were unable to progress to the following stage. It is clear that recovery from these specific phobias takes time. The treatments must be repeated until users are more confident in their ability to confront the insects face-to-face. As a result, the creation of the Insecto-Aid app shows efficacy, although more time is required for the treatment to produce improvement.

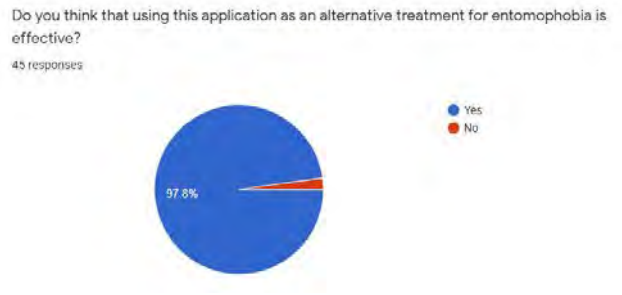

Fig. 16. Result on users' opinion on whether the treatment application is effective

The respondents were asked whether they believe that using this program as an alternative treatment for entomophobia is effective, as illustrated in figure 16. The conclusion was that 97.7% of the respondents said yes, while the remaining 2.2 percent said no. As a result of this finding, the majority of respondents agree that utilizing Insecto-Aid as an alternate treatment for entomophobia is effective.

VI. CONCLUSION AND RECOMMENDATION

In conclusion, the implementation of augmented reality in an entomophobia smartphone application was a success. The mobile app prototype was also put to the test to confirm that it worked properly. Furthermore, the project's objectives have been met. It is hoped that the few selected benefits presented in this study would encourage others to use AR technologies in health treatment.

A. Limitation

Time constraints impeded the study's implementation. Because of the worldwide Covid-19 outbreak, an electronic questionnaire was employed to collect data for a month after it was issued. The data can be more accurate with a large number of respondents who took the questionnaire online and in person. Other than that, the initial intention for the alpha testing was to interview a specialist on specific phobias, however because to the Covid-19 outbreak, this idea was discarded. And lastly, rather than being a smart phone-based augmented reality app, as stated in the research objectives, the software was created to function exclusively on Android. This is due to the fact that, despite its significant market share in the smartphone business, Android OS has the lowest operating expenses.

B. Future Recommendation

This project was effectively developed and implemented. It can, however, be improved in the upcoming round of study to target more advanced and better applications. A similar study with a bigger sample size and over a longer period of time might be undertaken to assess and acquire precise results for the AR treatment in curing entomophobia. Creating an augmented reality application to treat entomophobia with more features and insects. In addition, animating insects to move about rather than sit still will improve the user experience during the treatment procedure. The AR mobile app might be made to work on a variety of operating systems rather than just Android. This would make AR technology more generally usable, not just for Android users, but for everyone who owns a smartphone. To design a mobile application for entomophobia treatment that uses a different target marker. Instead of stickers, other objects in the environment or body parts could be used. This would provide users with more choice for where the virtual insects should appear.

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