Immersive Virtual Reality: A New Dimension in Physiotherapy

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Abstract*—Physiotherapy treatments often necessitate patients to perform exercises at home as part of their rehabilitation regimen. However, outside the clinic, patients are often left with inadequate guidance, typically provided in the form of static images or sketches on paper. The ongoing COVID-19 pandemic has further disrupted the ability for patients and physiotherapists to engage in face-to-face sessions, leading to suboptimal compliance and concerns about the accuracy of exercise performance. In recent years, there has been a growing body of scientific literature on the application of virtual reality (VR) in physiotherapy. This emerging trend highlights the potential of VR technology to enhance the guidance and effectiveness of physiotherapy regimens. This research paper aims to investigate the impact of VR-based physiotherapy on the guidance and completion of prescribed exercises. To address the limitations faced by patients unable to access in-person physiotherapy due to the pandemic or geographical constraints, we propose the FisioVR application, specifically designed for Android devices. What sets FisioVR apart is its intrinsic guidance and support from physiotherapy experts. To evaluate the effectiveness of FisioVR, we conducted tests with eight respondents who provided valuable feedback via an online form. The results clearly demonstrate that each physiotherapy session carried out using FisioVR has a positive impact and is conducive to achieving the intended therapeutic objectives, effectively promoting recovery. In summary, FisioVR has the potential to bridge the gap between patients and care providers, facilitating home-based and individualized physiotherapy. This innovative application leverages the power of virtual reality to offer a more accessible, guided, and personalized approach to physiotherapy, especially crucial during times when in-person sessions are challenging.

***Keywords*—Android; COVID-19; physiotherapy; virtual reality**

I. Introduction

The COVID-19 pandemic has significantly disrupted traditional healthcare practices, including physiotherapy, which often requires patients to perform prescribed exercises at home. In the absence of face-to-face guidance from physiotherapists, patients are left with limited resources, such as static photographs or sketches, to assist them in correctly completing their exercises [1].

In response to these challenges, the field of virtual reality (VR) rehabilitation has gained momentum in recent years [1]. Scientific reports and research studies, published in reputable journals, have highlighted the potential of VR in enhancing physiotherapy guidance and improving patient outcomes [1]. The integration of VR technology into physiotherapy offers a promising solution to address the constraints imposed by the pandemic, as well as the geographical barriers that prevent individuals from accessing physiotherapy facilities [4].

This paper aims to investigate the impact of VR-based physiotherapy on the guidance provided to patients for completing their prescribed exercises. It introduces the "FisioVR" application, designed for Android platforms, as an innovative solution to the current challenges faced by patients seeking physiotherapy [2]. FisioVR is developed in collaboration with physiotherapy experts, ensuring that it aligns with established rehabilitation principles and practices [2].

To assess the effectiveness of FisioVR, eight respondents participated in testing and provided valuable feedback through an online form [3]. The results of this study indicate that each physiotherapy session conducted using FisioVR positively impacts patients and demonstrates a tendency to achieve the intended therapeutic objectives effectively [3]. Thus, FisioVR has the potential to offer patients and care providers an opportunity to engage in home-based and personalized physiotherapy, overcoming the limitations imposed by the pandemic and geographical distance [3].

In this rapidly evolving landscape of healthcare technology, this research paper contributes to the growing body of evidence supporting the utilization of VR in physiotherapy, highlighting the potential benefits it offers in guiding patients through their rehabilitation exercises. Through this investigation, we aim to provide a comprehensive understanding of the role of VR in modern physiotherapy and its implications for improving patient care and outcomes [4].

The remainder of this study is structured as follows: Section II presents related works. Section III deals with the propose application. The experimental results are described in Section IV. Section V presents the testing and evaluation. Lastly, in Section VI, the study concludes by summarizing the key findings and future works.

II. Related Works

Numerous research studies have suggested that different therapy approaches are evolving to meet market demands. One of these innovations is Mirror Therapy VR, as highlighted in study [8]. This therapy leverages feedback tools to enable users to immerse themselves in therapeutic exercises. The exercises featured in this application are straightforward and involve repetitive hand movements. The primary goal of these exercises is to enhance motor skills while reducing sensory and perceptual issues.

The user's experience involves being presented with a camera screen that mirrors both the left and right hands, as depicted in Fig. 1. This setup allows users to concentrate their efforts on a single limb, potentially enhancing the effectiveness of the therapy process. However, it's worth noting that this function may induce a sense of dizziness, as the movement of the left and right eyes is not synchronized, which can disrupt the user's focus. Additionally, this exercise typically requires guidance from a specialist who can provide oral instructions throughout the therapy session.

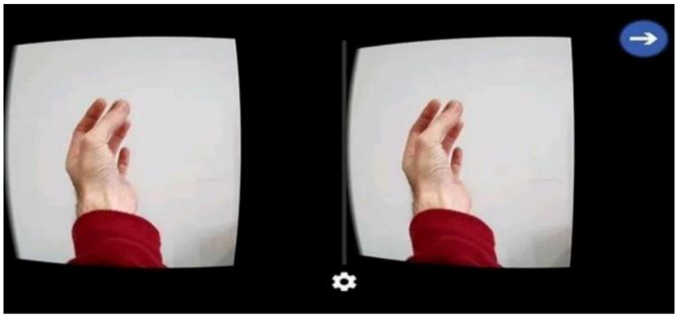


Fig. 1. Screenshot of mirror physiotherapy VR application.

Enhancements to this application could be achieved by introducing a 3D animation feature. This 3D animation would serve as a visual aid, effectively illustrating the instructions provided by the instructor. It would play a crucial role in guiding users step by step through the therapy regimen. Moreover, the 3D animation component could offer valuable support and motivation through verbal encouragement, thereby ensuring users' successful completion of the therapy. The advantages, disadvantages, and improvement suggestion for the Mirror Therapy VR application have been thoughtfully consolidated in Table I.

TABLE I. SUMMARIZE OF MIRROR PHYSIOTHERAPY VR APPLICATION

Mirror Physiotherapy VR Application		
Advantages	***Disadvantages***	***Improvement Suggestion***
Both left and right camera views are synchronized to help increase focus	Only one camera but separate into two lens view which users will lose focus and feel dizzy	Focus on only a single hand when doing the therapy
Only have two simple option in the main menu	Requires attention and guidance from a specialist when using the application	Develop an animation to guide the users while doing the therapy
	Paid application (USD 0.99)	Provide a free version of the application

The Computer Assisted Rehabilitation Environment (CAREN) system has garnered a notably positive response from patients, as mentioned in study [5]. The core of CAREN lies in its incorporation of gaming elements. This sophisticated multi-sensory VR system was specifically developed to address human locomotion, encompassing aspects such as posture and motor control integration [6]. However, it's essential to note that this system's magnitude necessitates specialized personnel for operation.

Moreover, the CAREN system fosters cognitive skills by requiring users to make decisions and solve problems, depending on their chosen therapy level, as evident in Fig. 2. It's a substantial system that predominantly operates within the realm of non-immersive VR technology. Nonetheless, its relatively large scale and dependency on interaction with other devices or resources can pose logistical challenges, as it is not very compact and can be time-consuming to set up and dismantle [5].

Fig. 2. CAREN system.

Additionally, complex systems often entail substantial operational expenses, especially when they rely on extensive equipment and facilities. Even with single-user operation, the need for assistants or operators persists, making resource utilization somewhat inefficient. To address these issues, there is a compelling need for a mobile application that can enhance the system's accessibility, allowing users to experience it from any location. This can be achieved by packaging the framework into an APK file that can be downloaded and utilized on smartphones. Such an introduction would not only improve overall usability but also invigorate users by providing the sensation of being in a different environment, thus mitigating the need for large screens. Table II conveniently summarizes the advantages, drawbacks, and suggestions for enhancing the CAREN system application.

TABLE II. SUMMARIZE OF CAREN SYSTEM APPLICATION

CAREN System Application		
Advantages	***Disadvantages***	***Improvement Suggestion***
Unique for each of the patients. The games will be based on the ability of the users	It can't be carried anywhere because of the bigger size	Create a mobile phone application to make it remotely
Only have two simple options on the main menu	High maintenance cost	Apply the VR feature which is immersive
Most advanced technology in the biochemical laboratory	Requires many experts to help one patient	Provide a free version of the application
Games with physiotherapy features		

Table III serves as a valuable repository of pertinent information pertaining to the three chosen applications. Delving into the specific attributes of each application equips us with a comprehensive understanding of their respective functionalities and contexts. Moreover, drawing comparisons between these applications and leveraging their individual strengths and weaknesses is vital when it comes to enhancing the current application. By digitally transforming these attributes into features, we can create a more robust and user-centric physiotherapy VR experience. This proactive approach ensures that the user's evolving needs are met and that their physiotherapy journey is continually improved.

TABLE III. COMPARISON BETWEEN THE TWO APPLICATIONS

Application Name	Main Menu	Content Presentation	Animation	Physiotherapy demonstration	User Manual	Camera Usage
Mirror Therapy VR [7]	×	Requires experts help	×	×	×	✓
CAREN System [8]	✓	Requires experts help	✓	✓	✓	×

In conclusion, the CAREN system is challenged by its significant costs, intricate nature, dependence on clinical settings, and the need for specialized training. Conversely, mirror therapy's limitations lie in its restricted applicability, reliance on patient motivation, absence of structured feedback mechanisms, and its simplicity, which may be inadequate for cases requiring advanced technology. A comprehension of these shortcomings aids in making informed decisions when choosing the most suitable rehabilitation approach for a particular patient or condition. Hence, this research paper aims to introduce FisioVR, a solution designed to address the shortcomings of traditional physiotherapy methods, such as the high costs and complexity associated with advanced systems like the CAREN system and the limited applicability and feedback mechanisms in the case of mirror therapy. FisioVR, as outlined in the conclusion above, strives to provide an accessible, cost-effective, adaptable, and patient-centric approach to rehabilitation, ensuring that each patient's unique needs and circumstances are effectively addressed. Through this introduction, we hope to shed light on the potential of FisioVR to transform the landscape of physiotherapy by offering a more inclusive and tailored rehabilitation experience.

III. PROPOSE APPLICATION

The purpose of the study is to facilitate the features in VR, driven by the purpose of making physiotherapy remotely, enhancing the capabilities and effectiveness of the home-based physiotherapy with minimal supervision. The prototype of the application is developed using the open-source programming which is C#, 3D models, API plugin and external software in which all of them integrated to bringing the best outcome possible made for the user.

A. FisioVR Flow Chart

In Fig. 3, the corresponding flowchart describes more information regarding this application. This application allows to be initiated by the user and will be immediately taken to the main menu. The second task is signing in, but the user is expected to register if they already do not have an account. If the registration has done, the user will be taken straight to the select physio menu. The user will be taken back to the login menu if the login information is incorrect. The application verifies until the user can reach the FisioVR application by checking the cloud database used, Firebase, and grants the user access with the right username and password [9].

Otherwise, the correct username and password have to be entered again by the user. Once logged in, the user will be given several physiotherapy options to choose, making it easy for them to perform more than one therapy as soon as the first therapy is completed. When the therapy starts and the user exits the therapy, the user will be asked to finish automatically or exit to the physiotherapy options menu. From the physiotherapy options menu, users can exit the application by pressing the log out button and will be taken directly to the main menu which is the menu before logging in.

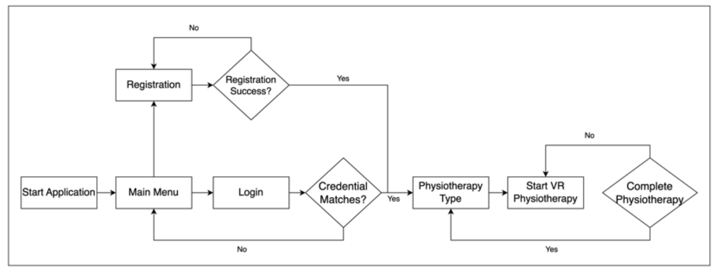


Fig. 3. FisioVR flow chart.

B. Application Architecture

Development of the application highly prioritise user experiences and the outcome of using the application. Contributing to the main objectives, few approaches are taken which the development will take place in UNITY 2018.3.6f1 version. Storing user's basic data into firebase enables users to log in into the applications with the correct credential. Integrating few other external resources which are Mixamo website for the 3D model, Rest API for log in features and UMotion for creating the animation movements from the scratch. This animation Editor also consists of a wide library that developer wish to design including controlling the face expression of a model and other basic movements. Fig. 4 shows the FisioVR Application Architecture. By utilizing the features in all of the sources, FisioVR Application were developed and consists of Login Menu, Registration Menu, Pick Physiotherapy Menu, Elbow Tennis Physiotherapy World, Knee Physiotherapy World, Leg Physiotherapy World, Shoulder Physiotherapy World and Exit Menu. All of the features offered in the application is in conjunction with user's request based on the data and feedback provided.

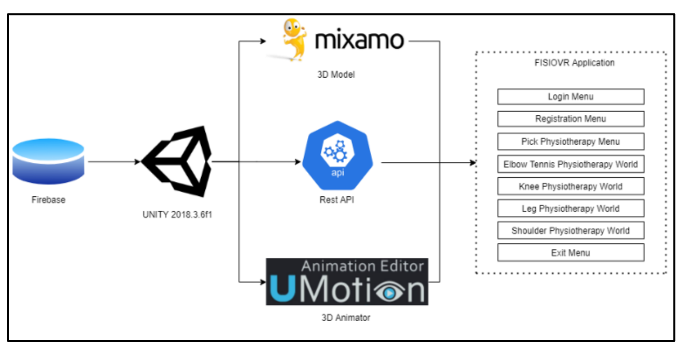


Fig. 4. FisioVR application architecture.

C. *Activity of Feature-based in FisioVR*

This step involves in identifying the scope and context of this application to avoid unnecessary and redundant features. The application menu consists of eight modules: Login Menu, Registration Menu, Pick Physiotherapy, Elbow Tennis Physiotherapy World, Knee Physiotherapy World, Leg Physiotherapy World, Shoulder Physiotherapy World and Exit Menu which Login Menu, Registration Menu and Pick Physiotherapy World are connected to the Firebase Database as shown in Fig. 5. With all modules progressively integrated, an overall model are made.

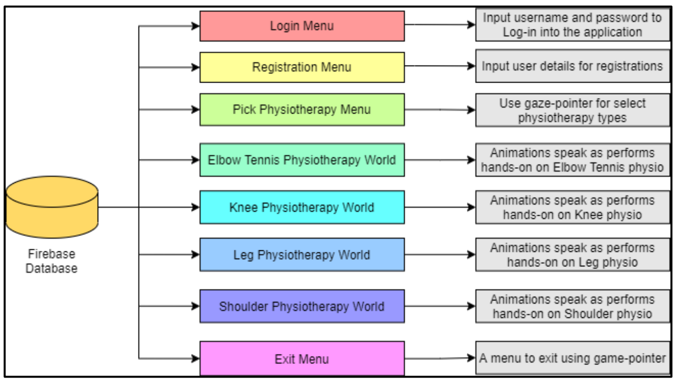


Fig. 5. FisioVR modules.

D. *Basic Movement of Physiotherapy*

Physiotherapy is processed in this application using a system named UMotion. This software is freely accessible at the Unity Asset Store and facilitates the power of 3D animation for simple physiotherapy. Each movement is considered a node and matches human bone movement as seen in Fig. 6 where the following UI is the UMotion interface. UMotion uses a skeleton to regulate 3D animation activity in the human body [10] and for up to 13 seconds, UMotion can assist limb movement [11, 12]. UMotion software will generate short clip animations and integrate all animations then render them using the Unity software's animators. This movement network requires trigger mechanism based on the user chooses. Advancing from the login menu into the pick physiotherapy world, user will use gaze-pointer with the timer of three seconds on any type of physiotherapy featured in this VR application which will divert the user the physiotherapy world.

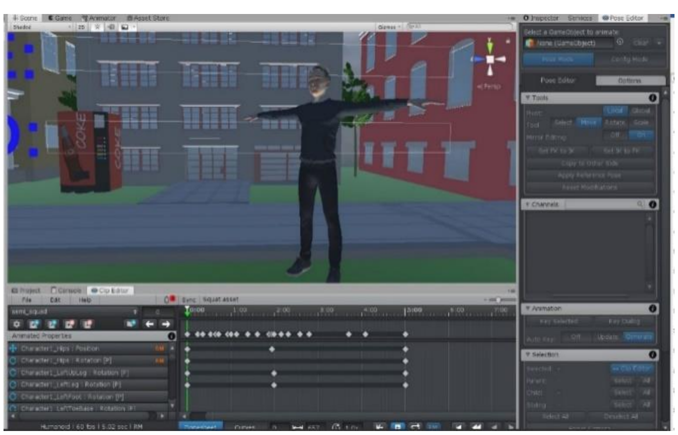
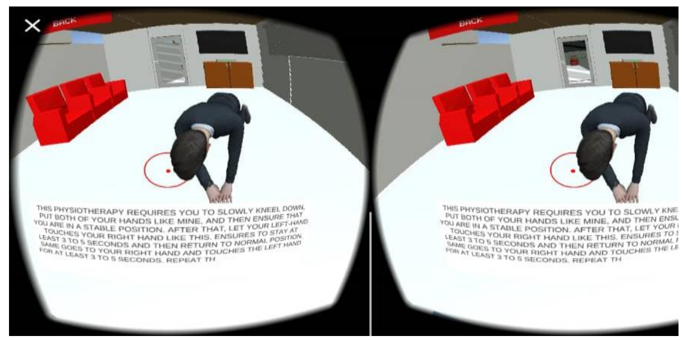


Fig. 6. Umotion user interface.

1) 3D animated movement chain (shoulder): As shown in Fig. 7 and Fig. 8, it is a series of 3D animated movement for shoulder physiotherapy based on previous researcher [13]. Each movement must start with the "Entry" button where it is the starting point of this animation. "Phy_standing" means "idle" or empty animation movement such as standing alone without doing any action. After a few seconds, this animation will do shoulder physics slowly down first and start shoulder physiotherapy from left to right, right to left, then got up again. Each physiotherapy will be done repeatedly according to the user's wishes until the user exits this interface.



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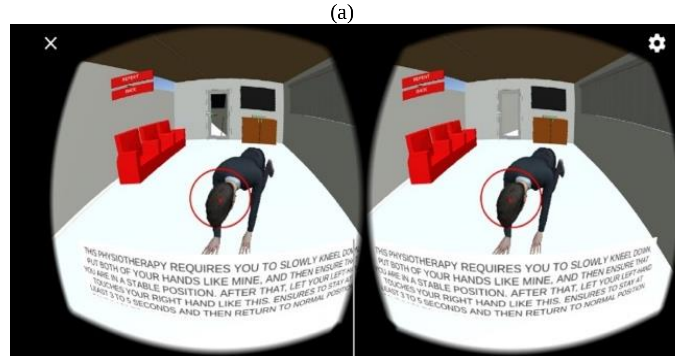

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Fig. 7. 3D animation for shoulder physiotherapy.

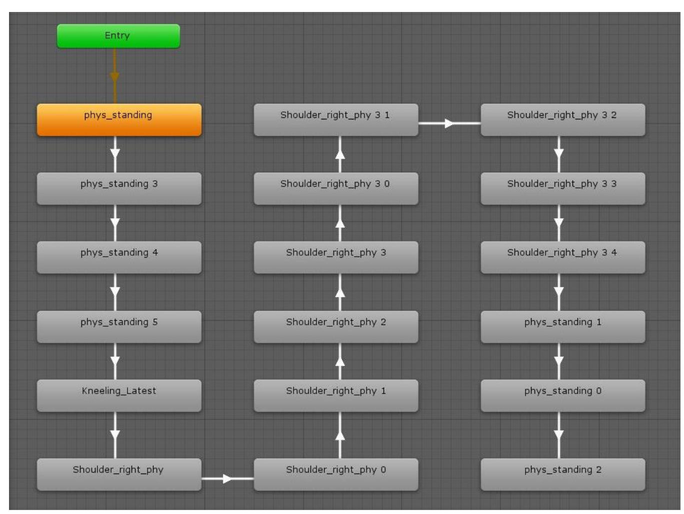
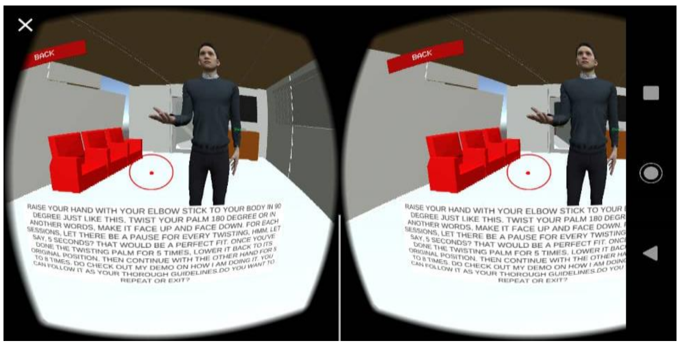


Fig. 8. Chain movement 3D animation – shoulder physiotherapy.

2) 3D animated movement chain (elbow): Fig. 9 and Fig. 10 represent a chain of movement of this 3D animation which also begins with the Entry pint. Each movement should start with an idle phase where it gives instructions on how to do the physiotherapy using sounds and text displayed on the screen. After a few seconds, this 3D animation starts its physiotherapy by raising the virtual avatar's hand in half and then turning it by 90° and turning back to the original position and lowering it. It is connected by raising one hand to do the same thing. This same process will be repeated several times and ask the user if they want to repeat it. If so, the animation will repeat the same process until the user wants to stop, then this 3D animation will stop and the user will exit manually using the button provided.



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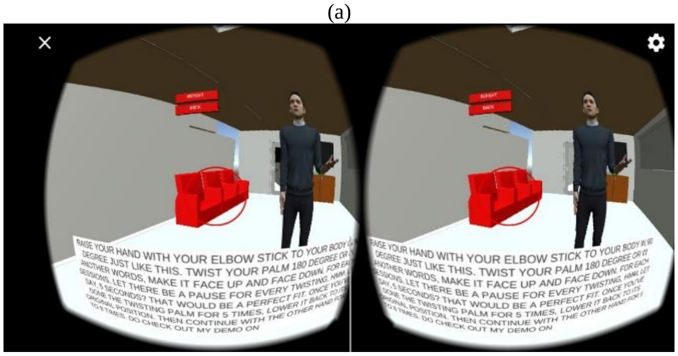

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Fig. 9. 3D animation for elbow physiotherapy.

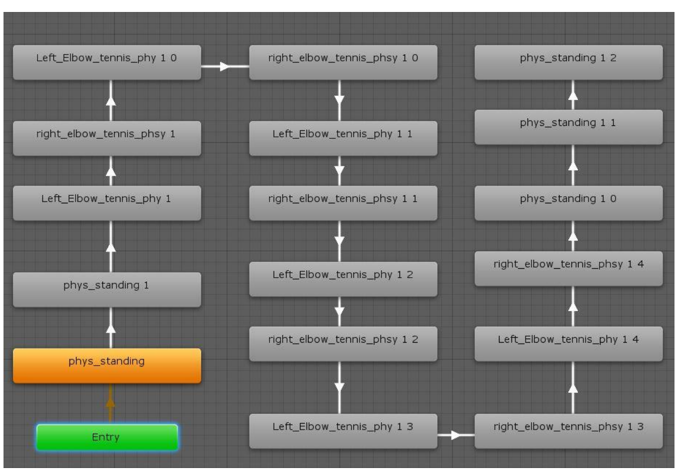
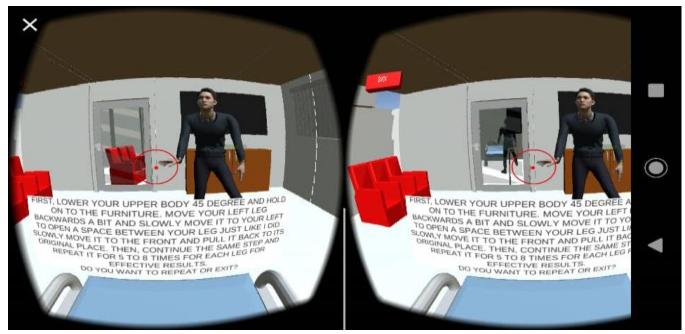


Fig. 10. Chain movement 3D animation – elbow physiotherapy.

3) 3D animated movement chain (foot): Foot movement is one of the relatively tricky physiotherapies, it must start from the foot's base to strengthen the foot movement. Therefore, this physiotherapy option requires the user to stand. If there is a problem to stand, it is recommended to have a caregiver who can consist of his own family to provide assistance to stand if necessary. In this animation, the user should bend the body by 35% - 45% to ensure the legs get a moderate load. Next, the user will lift the left leg first, move to the left and slowly turn until the foot is forward and return to the original position at a slow pace. This process as usual will be repeated according to the needs of the user. Both the left and right legs will do the same physiotherapy. Fig. 11 and Fig. 12 show that this 3D animation's movement is controlled and in order so that the user can slowly adjust to this pain and physiotherapy.



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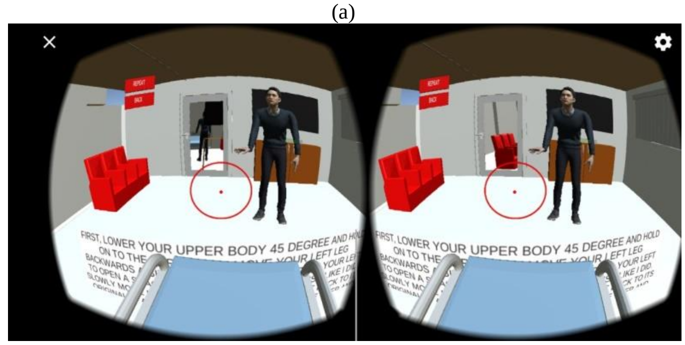

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Fig. 11. 3D animation for leg physiotherapy.

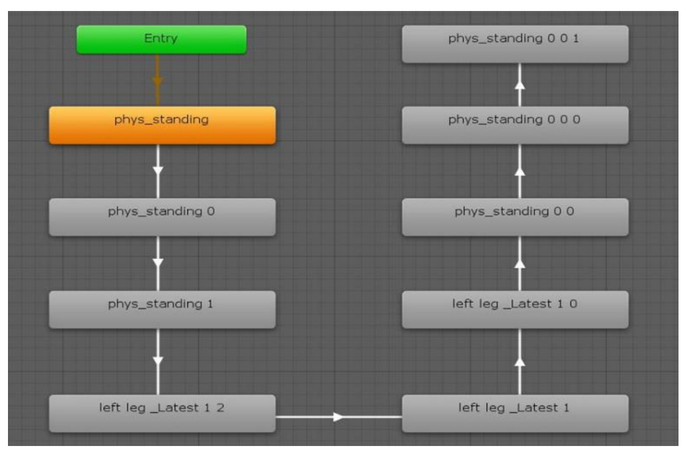
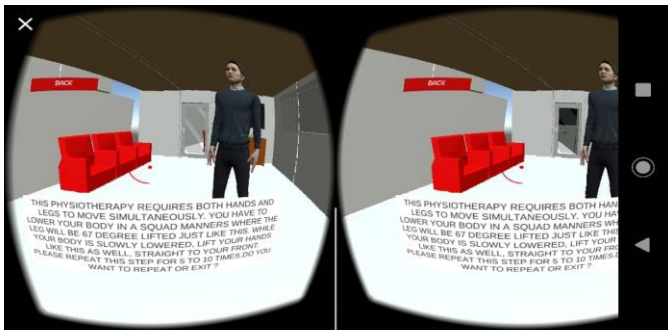


Fig. 12. Chain movement 3D animation – leg physiotherapy.

4) 3D animated movement chain (squat): The basic human movement must have strong support from the lower body. Therefore, physiotherapy should be included the lower limbs exercise to make them stronger. This physiotherapy involved simple movement where the animation will teach users to do basic squats. Fig. 13 and Fig. 14 represent the animation network that was successfully compiled and became a large network to move this animation to perform squats exercise carefully according to their ability.



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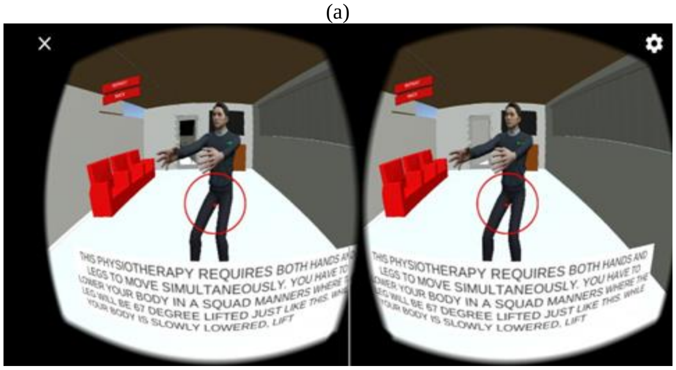

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Fig. 13. 3D animation for knee physiotherapy.

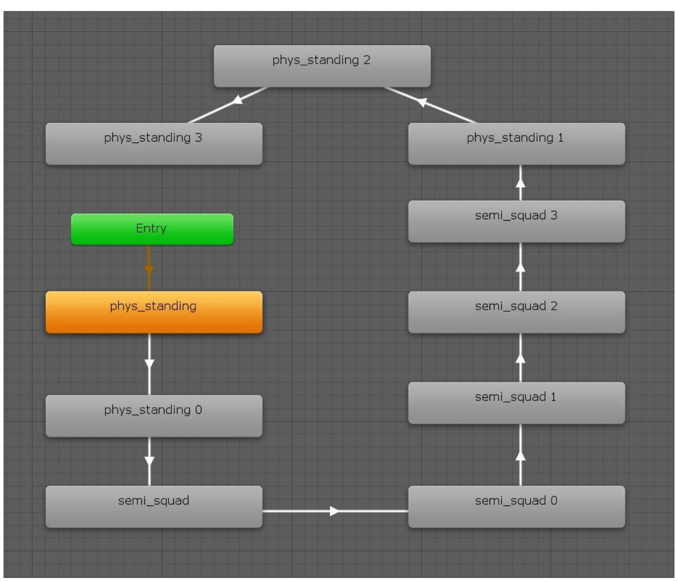

Fig. 14. Chain movement 3D animation – squat physiotherapy.

IV. Results

he FisioVR application places a strong emphasis on delivering a virtual reality (VR) interface that immerses users into an alternative realm, a concept known as "immersive reality" [1]. Studies, such as the one featured in Physiopedia 2018, provide compelling evidence that therapists can effectively manipulate the virtual environment to positively impact patients [3]. In addition to the therapeutic content, the application's interface plays a pivotal role in ensuring the efficiency of therapy sessions and capturing the users' attention and focus [5].

Advanced cognitive skills come into play as users engage with 3D animations and assimilate pertinent knowledge within the therapy context. Fig. 15 illustrates the key aspects of the FisioVR application:

1) User login: Users initiate their FisioVR journey by logging in or becoming a member. The main menu serves as the entry and exit point for the application, and background music accompanies the user upon entry, persisting as they revisit the application from the beginning.

2) Registration: The FisioVR registration interface, as shown in Fig. 15(b), caters to individuals who are not yet members. Here, users are prompted to provide essential details such as their name, gender, username, and password. This information is securely stored in the cloud database for future login verification.

3) Scene selection: Within Fig. 15(c), users choose their preferred types of physiotherapy. The serene background music contributes to a sense of inner calm and mental tranquillity, preparing users for the physiotherapy experience ahead.

4) Expert guidance: Fig. 15(d) captures the phase where users actively engage in physiotherapy, guided by an expert. This scene features animations and written instructions to aid users in their therapy journey. While discomfort may arise during physiotherapy, the accompanying music is designed to soothe and ease any tension. Upon completing the therapy session, users can exit the application by directing their gaze towards the left rear button in Fig. 15(d). This action returns them to the scene where they select their preferred type of physiotherapy as sown in Fig. 15(c). To exit the application entirely, users must select the back button, which returns them to the main menu as shown in Fig. 15(a).

5) Exiting the application: The "exit" button, displayed in Figure 15.e, provides users with the option to leave the application. Choosing "yes" allows users to exit, while those wishing to engage in physiotherapy again will need to log in by entering their correct username and password.

In essence, the FisioVR application offers an immersive and structured platform for users to engage in physiotherapy while incorporating interactive elements to ensure an effective and engaging experience.

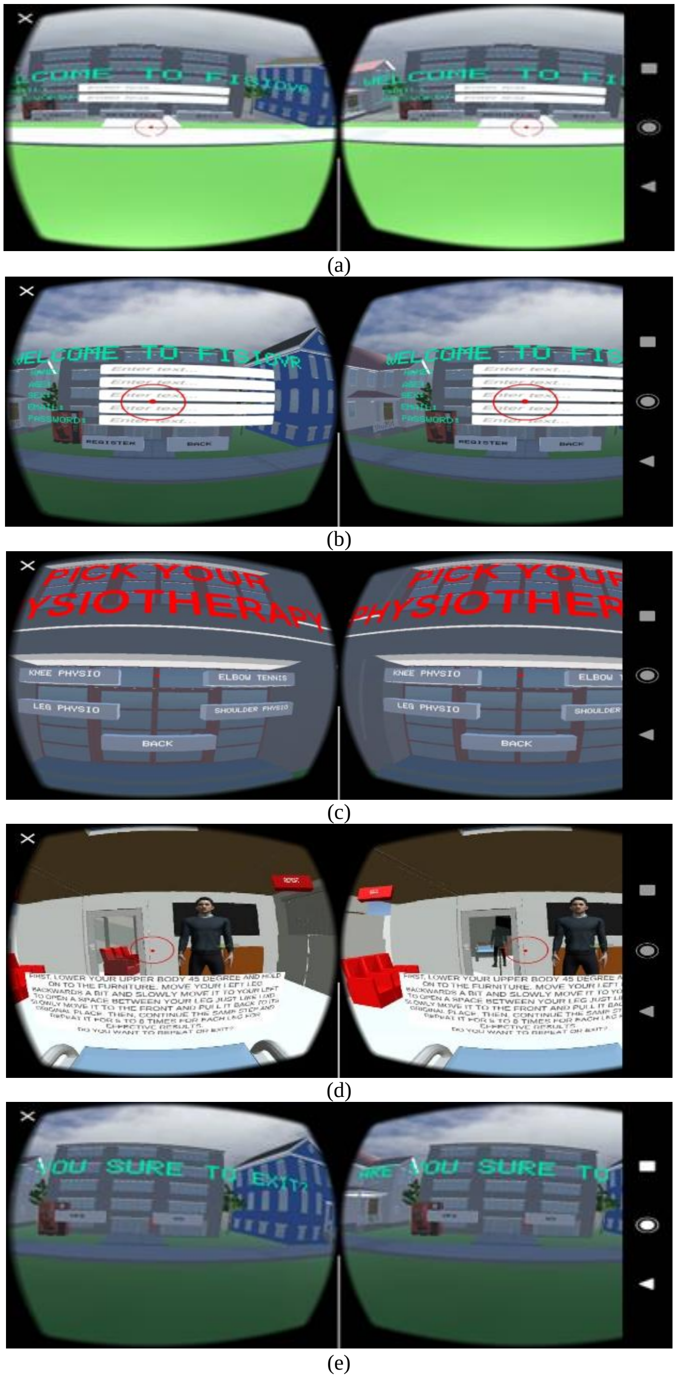

Fig. 15. Interface of FisioVR: (a) Main menu, (b) Registration user interface, (c) Pick physiotherapy menu, (d) Physiotherapy room user interface, (e) Log out user interface.

V. Testing and Evaluation

Users will get a set of questions after using the FisioVR application to get detailed feedback on the user experience while using the FisioVR application. The questions contain several factors, namely the application's applicability to the user, the level of pleasure, effectiveness and satisfaction for this application [14-17]. As shown in Table IV, it is about the Likert scale and the level of performance for each usability in this application. The beginning of this scale is one that means strongly disagree and has a maximum of five which is strongly agreed.

TABLE IV. Likert Scale and Performance Level

Likert Scale	Performance Level
0-1.67	Poor
1.68-3.34	Average
3.35-5	Good

The Likert scale is used only to find the overall average [18]. Getting information with very minimal errors requires several approaches. One of them is to make a feedback experiment from some respondents who have a high probability of becoming regular users of this application. A total of eight respondents successfully tested this application. The respondents consisted of several potential users who did physiotherapy at a private physiotherapy clinic. They had successfully provided feedback through the online feedback form. Table V determine each of these factors depending on the survey questions.

TABLE V. Questionnaire Results

Factor	***Mean ± SD***
Application Functionality	**4.25 ± 0.44**
FisioVR manages to fulfill my needs	4.25
FisioVR helps me to be more pro-active	3.63
FisioVR contains all the functions that I need	4.25
3D animation is handy to me to do physiotherapy	4.88
Ease of Use	**4.40 ± 0.52**
FisioVR contains content that is compact and details	4.5
FisioVR is user-friendly	4.63
FisioVR is very easy to use	4.75
Minimal attempts to get used to the virtual world	4.63
Entering data input is relatively easy	3.25
It can be done without the user manual	4.63
Efficiency	**4.59 ± 0.22**
FisioVR uses minimal time taken to use	4.5
The application has zero to minimum errors	4.38
3D animation visualization helps the interpretation of physiotherapy (motion style)	4.9
Satisfaction	**4.58 ± 0.12**
Interesting user interface	4.75
FisioVR has unique features for virtual reality	4.5
I am very satisfied with the functionality of the application	4.5

The results unambiguously demonstrate that respondents have unwavering confidence in the effectiveness of this application. They assert that it not only fulfills its intended objectives but also leaves room for further enhancements, with the potential to create a product akin to FisioVR that can cater to a wider user base. Table V is instrumental in this regard, as it encapsulates four distinct factors, accommodating diverse individual needs, application contexts, and overall software usability. Feedback, for the most part, aligns with a positive outlook, marked by "good" and "satisfactory" ratings. However, one exception stands out—moderate ratings are assigned to the ease of data entry and input functionality, primarily owing to the absence of virtual reality keyboards.

In terms of application functionality, the positive impact is clearly articulated. Users report a higher degree of proactivity and, significantly, a potential life-changing experience as they gradually regain their spirits and motivation. FisioVR distinctly exhibits its ability to meet users' requirements. The incorporation of 3D animations contributes to clearer message visualization, supported by low standard deviations. Notably, the 3D animations stand out with high scores in both functionality (Likert Scale: 4.88) and efficiency (Likert Scale: 4.9) within FisioVR. This feature enhances the application's reliability and furnishes vital functionalities.

The application's assistance is specifically acknowledged for its role in helping users become more proactive and enhancing their overall well-being. This transformative aspect holds the promise of positively impacting users' lives as they gradually regain their spirits and motivation. FisioVR effectively addresses users' needs and provides clear message visualization through 3D animations. The application's content is highly informative and compact, making it both user-friendly and comprehensible at first use. While user feedback may not always be straightforward due to time and space constraints, it is poised for ongoing improvements. Favorable recommendations play a pivotal role in discerning priorities, ensuring that patients and users can perform their physiotherapy conveniently and receive positive feedback on ease of use. FisioVR places a stronger emphasis on performance rather than sheer ease of use. Understanding the simple and harmonious relationship between humans and machines yields a captivating user experience and efficient use of time. FisioVR records the highest average for total 3D animation interpretations in this context, with the animation timescale aiding users in understanding their virtual environment and navigating it through gaze pointers and user-driven interactions.

Satisfaction, a crucial component, keeps users engaged and delighted while using the application. Overall user satisfaction rates relatively high, with a standard deviation of 0.12, which is the highest among all variables. This underlines the successful achievement of the main objectives—identifying users' fundamental needs for the application and developing a VR application that empowers users to perform physiotherapy at home through practical and accessible methods. The efficiency section ranks highest in terms of user satisfaction, and the third point, emphasizing the role of animated 3D visualization in making physiotherapy more efficient and effective, garners the highest average rating. In contrast, the lowest average is associated with the "Convenience of Use" and the fifth point, where data entry and input present challenges and necessitate experimentation, with an average rating of 3.25. Table V distinctly underscores the significant importance of this application as an innovation that is much needed in today's context.

In comparison to the CAREN system and mirror therapy system, the advantages of the FisioVR application primarily revolve around accessibility, cost-effectiveness, adaptability to remote conditions, patient engagement, and potential for customization with expert support. FisioVR offer a practical solution for patients facing barriers to traditional physiotherapy, including those related to the COVID-19 pandemic and geographical limitations. However, the choice between these systems would ultimately depend on the specific needs and conditions of the patients and the goals of the rehabilitation process.

VI. Conclusion and Future Works

The FisioVR application employs highly effective 3D animations to illustrate the preferred types of physiotherapy in a visually engaging and user-friendly manner. This innovative application, developed in the course of this study, enables users to execute physiotherapy sessions with ease. The success of this output was confirmed through a comprehensive evaluation conducted via an online feedback form. The results unequivocally demonstrate that this application has significantly benefited users, effectively addressing their specific needs.

With UMotion, each physiotherapy movement becomes a unique and easily comprehensible 3D animated motion. Auditory cues and visual indicators elucidate the steps and techniques involved in performing physiotherapy, ensuring that users can follow the instructions seamlessly. Importantly, this application relies minimally on the internet, primarily for tasks such as account registration and login. The core scenes involving animation and VR operate independently of internet connectivity.

However, certain limitations should be acknowledged regarding the FisioVR application's scope. It currently offers support for only a selection of fundamental physiotherapy types, including knee, shoulder, elbow, and leg physiotherapy. Expanding support to encompass a wider array of physiotherapy categories would enhance the application's versatility and user experience. To address potential challenges faced by users in adapting to the application, suggestions have been proposed.

One such suggestion is the creation of a VR keyboard, which would streamline registration and login processes, ultimately saving users time and reducing complexities. Implementing these improvements would render the framework more proactive and user-friendly. Additionally, enhancing the application's animations to convey a narrative and human-like movements would further engage users of all ages, making the guidance more relatable and appealing.

Moreover, extending compatibility to iOS-based devices is recommended to expand the commercial value of the FisioVR application. This step would enhance the application's reach and align with marketing strategies aimed at assisting a broader audience, particularly those in need of physiotherapy support.

Acknowledgment

This work was supported by the Ministry of Higher Education Malaysia (FRGS/1/2022/ICT10/UKM/02/2) and Universiti Kebangsaan Malaysia (UKM-TR2022-03).

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